THE POLYZOA
WITH A NOTE ON AN ASSOCIATED HYDROID

BY

ANNA B. HASTINGS, M.A., Ph.D.
Assistant Keeper in the Department of Zoology

WITH TWENTY TEXT-FIGURES AND ONE PLATE

INTRODUCTION.

As might be expected, this collection shows a close relationship between the Polyzoan fauna of the Great Barrier Reef and that of the Malayan region. Among the Entoprocta and the Ectoprocta, with the exception of the Ascophora, only two species (*Loxocalyx*, sp., and *Nolella alta*) have not been recorded from Malaya, and the latter is now known from China. Probably, when an account of the Ascophora of the "Siboga" Expedition is available, as close a relationship will be found there too. As will be seen from the list of species (p. 400), the collection adds considerably to the number of species known to occur on the reef.

Mr. A. A. Livingstone, of the Australian Museum, joined the expedition on Low Isles for the months of October and November, 1928. He collected ten species of Polyzoa, including one new species of *Petralia*. On his return he prepared a report on them and sent the specimens to the British Museum, keeping a duplicate series. Subsequently hearing that the collection made by the other members of the expedition was to be described by me, he suggested that it was undesirable to publish two reports, and, sending me his MS., gave me a free hand to use it in preparing my paper and to describe his new species. For this I offer him my sincere thanks.

I am also indebted to the Manchester Museum for lending me specimens from the Waters Collection, to the Cambridge Museum for a loan of specimens, and to Sir Sidney Harmer, K.B.E., F.R.S., for much very valuable help.

COLLECTING STATIONS.

Polyzoa were very scarce on the shore. Some colonies of *Retepora graeffei* developed on a box sunk in the shallow water of the Anchorage at Low Isles, and Mr. Livingstone's collection includes seven species, which he collected on the shore at Low Isles and Batt Reef.

The rest of the collection was obtained by dredge or trawl. The particulars of the six unnumbered stations from which Polyzoa were obtained and the abbreviated titles by which they are distinguished in this report are as follows :

N.E. Low Is. : September, 1928, off N.E. Low Isles, 8 fath., mud, dredge.
N.W. Low Is. : 5.ix.28, off N.W. Low Isles, 9 fath., mud, dredge.
Low Is., 12 FATH. : 16.x.28, off Low Isles, 12 fath., dredge.
OFF N. ANCHORAGE : 17.x.28, off N. Anchorage, Low Isles, 9 fath., sand, coral fragments, Agassiz trawl.
W. Low Is., 6 FATH. : W. of Low Isles, about 6 fath., mixed bottom.
W. Low Is., 8 FATH. : 15.xi.28, W. of Low Isles, 8 fath., mud.

Polyzoa were obtained from the following numbered stations :

II. 24.xi.28. Linden Bank, 28 fath., shell and sand, dredge 10 min. and 5 min.
VIII. 21.ii.29. 1½ miles N.W. Low Isles, 11 fath., mud, Agassiz trawl, 30 min.
IX. 22.ii.29. Penguin Channel, 12–14 fath., clean pit with mud at sides, 6 dredges about 20 min. each.
XII. 24.ii.29. Penguin Channel, 10–15½ fath., rock and shell gravel, mud on edges of pit, 5 dredges about 30 min. each.
XIII. 7.iii.29. ½ mile W. of Two Isles, 16½ fath., hard, 2 dredges, 20 min. each.
XIV. 7.iii.29. ½ mile S.E. of Lizard Is., 19 fath., shell gravel, rich *Halimeda*, 3 dredges, 20–30 min. each.
XXI. 11.iii.29. ½ mile N.W. Howick Is., 10 fath., mud and shell, Foraminifera, 2 dredges, 30 and 40 min.
XXII. 11.iii.29. To East of Snake Reef, 13½ fath., mud with Foraminifera and shells, 2 dredges ½ hour each.
XXIV. 13.iii.29. ¾ mile N.E. Pasco Reef, 16½ fath., hard shell bottom.

LIST OF SPECIES IN THE COLLECTION.

ENTOPROCTA.

**Barentsia gracilis* (Sars).
**Pedicellina compacta*, Harm.
**Loxosoma circulare*, Harm.
**L. pusillum*, Harm.
**L. breve*, Harm.
Loxocalyx, sp.

ECTOPROCTA.

CYCLOSTOMATA.

Crisia elongata, M.-E.
Mesonea radians (Lmk.).
Tubulipora pulcherrima (Kirkp.).

CTENOSTOMATA.

Amathia convoluta, Lmx.
**Nolella alta* (Kirkp.).
**Valkeria atlantica* (Busk).
Buskia setigera, Hcks.

CHEILOSTOMATA ANASCA.

**Aetea anguina* (L.).
**A. truncata* (Landsb.).
**Synnotum aegyptiacum* (Aud.).
**Caulibugula dendrograpta* (Waters).
**Beania regularis*, Thorn.
Nellia oculata, Busk.
**Didymozoum triseriale* (Phil.).
Retiflustra cornea (Busk).
**Scrupocellaria maderensis*, Busk.
S. diadema, Busk.
S. delilii (Aud.).
**S. spatulata* (d'Orb.).
Caberea lata, Busk.
**C. boryi* (Aud.).
**C. transversa*, Harm.
Acanthodesia savartii (Aud.).
Chaperia acanthina (Lmx.).
Setosellina coronata (Hcks.).
Cupuladria guineensis (Busk).

CHEILOSTOMATA ANASCA—*continued.*

Steganoporella buskii, Harm.
Thalamoporella rozieri (Aud.).
Cellaria punctata (Busk).

CHEILOSTOMATA ASCOPHORA.

Hippopodina feegeensis (Busk).
Lepralia montferrandii (Aud.).
**Schizomavella lata* (MacG.).
S. australis (Hasw.).
Emballotheca, sp.
**Stylopoma schizostoma* (MacG.).
**S. viride* (Thorn.).
**Hippothoa distans*, MacG.
Mastigophora pesanseris (Smitt).
**Trypostega venusta* (Norm.).
**Microporella ciliata* (Pall.).
M. malusii (Aud.).
M. mutabilis, sp. n.
**Smittina signata* (Waters).
**S. obstructa* (Waters).

CHEILOSTOMATA ASCOPHORA—*continued.*

**S. acaroensis*, Levins.
**Phylactella geometrica*, Kirkp.
Ciglisula areolata, Kirkp.
**C. cautium*, sp. n.
Petralia chuakensis, Waters.
P. vultur var. *serrata*, Living.
**P. litoralis*, Living. MS., sp. n.
Rhynchozoon longirostre (Hcks.).
Retepora graeffei (Kirch.).
R. monilifera var. *munita*, Hcks.
**R. monilifera*, var. *benemunita* (Busk MS.), var. n.
R. tubulata, Busk.
**Holoporella mamillata* (Busk).
H. fusca (Busk).
**H. intermedia* (MacG.).
H. tridenticulata (Busk).
**Catenaria lafontii* (Aud.).
Vittaticella elegans (Busk).

The species marked with an asterisk are additions to the lists of Queensland Polyzoa published by Livingstone (1926, 1927). Some of them have, however, been recorded from Torres Straits by Busk and Kirkpatrick, and *Barentsia gracilis* was recorded from Queensland by Waters.

ENTOPROCTA.

The number of clearly distinguished species of Australian Entoprocta is small, and it may be useful to give a list with references to the Australian records :

Pedicellina whiteleggii, Johnston and Walker, 1917, p. 60, = *P. cernua*, Whitelegge, 1889, p. 293.

Pedicellina cernua, Pallas, Kirkpatrick, 1888*b*, p. 21. This specimen from Port Phillip (B.M. 88.5.17.24) consists of three small individuals with short, much contracted stalks. In the characters by which *P. whiteleggii* is supposed to be distinguished from *P. cernua* it resembles the latter, having long spines, which are absent from the distal extremity of the stalk and from the calyx and are not conspicuously swollen at the base.

Pedicellinopsis fruticosa, Hincks, 1884*a*, p. 364. Johnston and Walker (1917, p. 62) give a list of subsequent records of this species.

Barentsia gracilis, Sars, Kirkpatrick, 1888*b*, p. 21 (see below, p. 402).

Barentsia laxa, Kirkpatrick, 1890*a*, p. 624.

In addition there are seven records of unnamed *Loxosoma* and two of *Pedicellina*. The latter were found by Goldstein (1880, p. 44) on *Retepora* and by Macgillivray (1887*b*, p. 221), both on the coasts of Victoria.

Two species of *Loxosoma* were found at Shark's Bay, W. Australia, by Macdonald (1877, p. 211), who took them to be spermatophores of the leeches to which they were attached. Goddard (1910, p. 725) rediscovered one of them, but apparently the calyx is deciduous, and with only the stalk known, the form remains undefined. Macdonald's figures would not be recognized even as representing Entoprocta.

Whitelegge (1889, p. 293) records a *Loxosoma* on the Sipunculid, *Phascolosoma australe*, but without description, and the form has not been rediscovered.

Haswell (1892, p. 330) found a *Loxosoma* on the long setae of the Polychaet *Coppingeria longisetosa*, Haswell, at Port Molle, but did not describe it. His figure (pl. xxvi, fig. 1) gives the appearance of the whole worm with the *Loxosoma* attached. I have found specimens in the same position on the same species of worm from the type-locality (B.M. 32.2.1.1) which may be assumed to be Haswell's species. It is near to *L. sluiteri*, Harmer (1915, p. 9), with which it agrees in size and general shape, in the number of tentacles, and in the absence of lateral lobes to the stomach and of cirri and lateral expansions on the calyx. It differs in not having the rather conspicuous cuticle of *L. sluiteri*. Buds are not common, but specimens with one or occasionally two have been seen. The vestibule frequently contains two embryos.

Waters (1904, p. 100) mentions, without description, a *Loxosoma* from Lizard Island, Queensland. The Manchester Museum has kindly lent me the slides of these specimens, showing four whole individuals and one in section attached to a plant stem. The species agrees with *L. circulare*, Harmer (1915, p. 16), in the stomach, gonads, embryos and buds and in the shape of the calyx. Its tentacles cannot be counted. Its average dimensions are: width calyx 218μ, length calyx 305μ, length stalk 305μ. It is thus larger than typical *L. circulare*. The dimensions of the larger " Siboga " specimens (358B) tentatively referred to that species lie between the extremes found in those from Lizard Island.

Finally there is the species from Port Phillip found by Harmer (1915, p. 5) on *Amathia wilsoni*. The smallest specimen measured agrees in size with the largest Barrier Reef *Loxocalyx*, but most are larger, being a little larger than *Loxosoma crassicauda*, Kirkpatrick (discussed below under *Loxocalyx*, sp.). The species on *Amathia* resembles that species in its thick stalk with longitudinal fibres and large cells, but the tentacles are more numerous, probably about 14, and no external sense-organs can be detected.

There are six species of Entoprocta in the Barrier Reef collection. The well-known *Barentsia gracilis* needs no further mention. The small size and wide difference of host of the other five makes it unlikely that they are identical with any of those dismissed above as unrecognizable, and none of them can be related to any of the unnamed Australian forms of which I have examined specimens, unless, when the range of variation of *Loxosoma circulare* is better known, Waters's *Loxosoma* from Queensland should prove to belong to that species.

Barentsia gracilis (Sars).

Pedicellina gracilis, Sars, 1835, p. 6, pl. i, figs. 2*a*, *b*.

Barentsia gracilis, Waters, 1904, p. 100; Ritchie, 1911, p. 840, pl. xlvii, figs. 5–7 (synonymy); Harmer, 1915, p. 27, pl. ii, fig. 12 (references); Annandale, 1922, p. 150; Hastings, 1927, p. 351.

Occurrence.—N.E. Low Is.; St. II, IX.

Distribution.—Queensland, New Zealand, Malaya, India, Red Sea, Mediterranean, Europe, N. Atlantic, Arctic.

Ehlers (1890, p. 143) thought that the description of *Ascopodaria gracilis* by Kirkpatrick (1888*b*, p. 21) might refer to *P. fruticosa*, Hincks, and not to *P. gracilis*, Sars. The only special resemblance to *P. fruticosa* mentioned by Kirkpatrick is the pointed end to the chitinous part of the stalk. As noticed by Harmer (1915, p. 28, footnote), this cannot be seen in Kirkpatrick's specimens. In some individuals the chitinous part does end abruptly at a little distance from the calyx, but the opening is not oblique. In

its very much smaller size and finer stolon and the absence of pores in the cuticle of the stalk, Kirkpatrick's specimens resemble *B. gracilis* and are unmistakably distinct from *P. fruticosa.*

Pedicellina compacta, Harmer.

Pedicellina compacta, Harmer, 1915, p. 24, pl. ii, figs. 13, 14.

Occurrence.—St. XII on *Caberea boryi.*

Distribution.—Aru Islands.

This specimen consists of one small individual and two buds connected to it by stolons, but the agreement with Harmer's description and paratype specimen leaves no doubt of their identity. The specimen is immature. Its dimensions are less than those given for adult individuals, but many of the younger individuals on the paratype slide are the same size. The rectum is recumbent. The calyx bears a number of short filamentous processes. At least four were detected in rolling the specimen over before mounting. Similar processes can be seen on the paratypes.

Loxosoma circulare, Harmer.

Loxosoma circulare, Harmer, 1915, p. 16, pl. i, figs. 14–16.

Occurrence.—St. II on *Retepora monilifera* var. *munita.*

Distribution.—Malaya.

Only a few specimens of this *Loxosoma* have been found in the Barrier Reef Collections, and it has not been possible to count their tentacles. There are certainly not more than 12. In size and shape the animals agree very closely with the type, but the calyx may be a little narrower. There may be two or three pairs of tactile processes and, as in some of the type-specimens, these spring from a narrow expansion of the body-wall, suggestive of that of *L. velatum*, Harmer, but much narrower and not continued on the stalk. The stalk bears a few irregularly distributed lateral processes (*cf.* Harmer, fig. 14). No individual has been seen with more than one bud. The structure of the genital organs cannot be made out.

Although some characters are uncertain, and others are not in complete agreement with those of *L. circulare*, I think the agreement is sufficiently close to justify the identification of the Barrier Reef specimens with that species.

As explained above (p. 402), the *Loxosoma* from Queensland mentioned by Waters (1904, p. 100) is closely allied to *L. circulare.*

Loxosoma pusillum, Harmer.

Loxosoma pusillum, Harmer, 1915, p. 16, pl. i, figs. 19, 20.

Occurrence.—St. II on *Retepora monilifera* var. *benemunita.*

Distribution.—Malaya.

Loxosoma breve, Harmer.

Loxosoma breve, Harmer, 1915, p. 19, pl. i, figs. 29–31.

Occurrence.—St. XXVIII on *Schizomavella australis.*

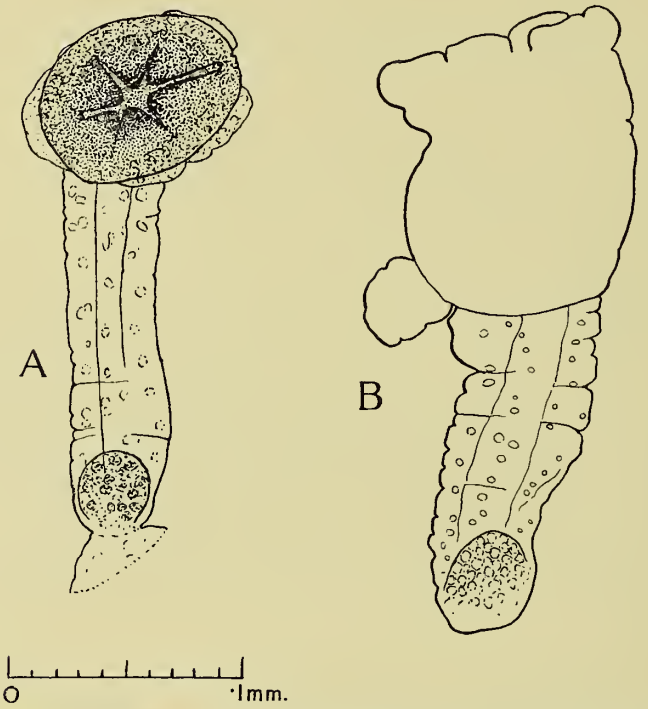
Distribution.—New Guinea.

A single individual of this species was attached to the outer surface of the operculum of its host, with its oral surface directed towards the opening of the compensation sac, *i. e.* proximally.

Loxocalyx, sp. (Text-fig. 1.)

Occurrence.—W. Low Is., 8 fath., on the Polychaet *Sthenelais malayana*, Horst (Monro, 1931, p. 8).

Description.—The calyx is, on the average, ·14 mm. long and ·09 mm. wide. The stalk is very little narrower than the calyx, and in its somewhat contracted condition, usually about the same length. The calyx of the largest specimen is ·20 × ·14 mm. The lophophore is only slightly oblique (Text-fig. 1, B), and bears, where it has been possible to count them accurately, 6 stout tentacles (Text-fig. 1, A). No external sensory processes have been seen. The anal papilla bears a tuft of long cilia and frequently projects beyond the inturned tentacles. The stalk has a few longitudinal fibres, and between them single



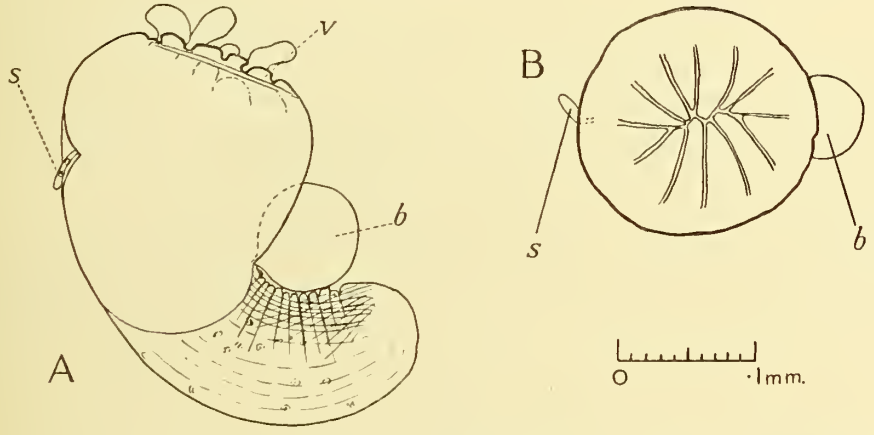
Text-fig. 1.—*Loxocalyx*, sp. Left side. A, With the calyx bent at right angles to the stalk, showing tentacles. B. Unbent, foot incomplete.

rows of large, unevenly-spaced cells. The foot-gland is more or less spherical and below it the stalk contracts and then spreads out to a disc-like foot, without wings (Text-fig. 1, A).

Remarks.—The presence of a foot-gland puts this species in *Loxocalyx*, although the duct has not been detected and the foot is not alate. Harmer (1915, p. 7) gives a list of the species of *Loxocalyx*, six being Neapolitan, one Malayan and one common to these two localities. The Barrier Reef specimens differ from all of them in their small size, in the small number of their tentacles, and in the very slight obliquity of the lophophore. The possibility must not be overlooked, however, that they are immature. The genital organs have not been observed, and the buds are at a very early stage of development. If so the animals might be expected to increase in size, and perhaps form more tentacles, and it is possible that the lophophore might become more oblique. *L. lineatus*, Harmer (1915, p. 6), which is the nearest *Loxocalyx* geographically, has a long slender stalk, and differs in the shape of the foot and in having membranous expansions on the calyx. It

thus seems probable that the Barrier Reef specimens represent a new species, but while the possibility remains that they are juvenile specimens, I prefer not to give them a name.

The specimens from the Tizard Bank (B.M. 89.8.21.70), tentatively identified by Kirkpatrick (1890*b*, p. 17) with *Loxosoma crassicauda*, Salensky (1877, p. 2), have been remounted, and show some resemblance to the Barrier Reef specimens in their general shape (Text-fig. 2, A), and in the structure of the stalk, which is thick, and has longitudinal muscles and large cells in between, but the longitudinal bands are more numerous, and no foot-glands can be detected. Three of the specimens are larger than the Barrier Reef *Loxocalyx;* the fourth has almost exactly the average dimensions of that form. They appear to have more tentacles, though not as many as *L. crassicauda*, Salensky. They cannot be counted with any certainty. Remounting has disclosed the presence of a characteristic organ, presumably a sense-organ. It takes the form of a slender, clavate



Text-fig. 2.—*Loxosoma crassicauda*, Kirkpatrick (*non* Salensky). A, One of Kirkpatrick's specimens. B, Distal view of a specimen from Tahiti. *b.*, Bud. *s.*, Sense organ. *v.*, Velum.

streamer of protoplasm containing one or two nuclei (Text-fig. 2A). One of these processes can be seen in each specimen. The edge of the velum is lobed. Better preserved material, which I believe to belong to this species, is growing on a shell collected by Dr. Crossland in Papeete Harbour, Tahiti (B.M. 29.4.25.5). There are twelve tentacles and a single, sensory process on the anal radius (Text-fig. 2, B). Owing to the smaller number of tentacles, the structure of the sense-organ and the rather less oblique lophopore, *L. crassicauda*, Kirkpatrick, must probably be distinguished from *L. crassicauda*, Salensky.

ECTOPROCTA.

Crisia elongata, Milne-Edwards.

Crisia elongata, Milne-Edwards, 1838, p. 203, pl. vii, fig. 2; Harmer, 1915, p. 96, pl. viii, figs. 1–8 (synonymy); Marcus, 1921*a*, p. 29; 1921*b*, p. 19; O'Donoghue, 1924, p. 24; Livingstone, 1927, p. 67.

Occurrence.—N.E. Low Is.; off N. Anchorage; St. II, XII.

Distribution.—Australia, Oceania, Malaya, Indian Ocean, Mediterranean.

All these specimens agree with Harmer's description of young colonies of this species, but as there are no ovicells the identification is uncertain.

Tubulipora pulcherrima (Kirkpatrick).

Idmonea pulcherrima, Kirkpatrick, 1890*b*, p. 22, pl. iv, figs. 6–6*b*.
Tubulipora pulcherrima, Harmer, 1915, p. 129, pl. ix, figs. 1–5 (synonymy).
? *Diaperoecia radicata*, Canu and Bassler, 1929, p. 538, pl. lxxxii, figs. 1–5.

Occurrence.—N.E. Low Is. ; W. Low Is., 6 fath. ; St. II.

Distribution.—New South Wales, Loyalty Is., China Sea., Malaya, Manaar, E. Africa.

The specimen from N.E. Low Is. is small, but shows ovicells, cross-connections and a rooting-column. The ooeciostomes are broken, but the complete agreement in other characters leaves no doubt of the identity of the specimen with *T. pulcherrima*. The material from other stations is fragmentary, but there is no reason to suppose that it does not belong to the same species.

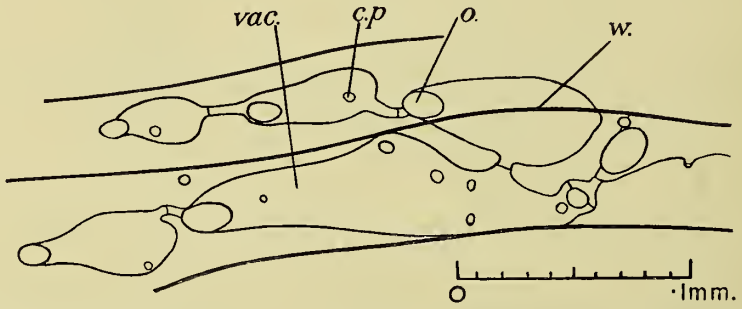
Mesonea radians (Lamarck). (Text-fig. 3.)

Retepora radians, Lamarck, 1816, p. 183.
Crisina radians, Harmer, 1915, p. 139, pl. x, figs. 6–8 (synonymy) ; Livingstone, 1927, p. 68.
Mesonea radians, Canu and Bassler, 1920, p. 762, text-fig. 250.

Occurrence.—N.E. Low Is. ; off N. Anchorage ; St. XI.

Distribution.—Australia, Oceania, Malaya, Indian Ocean.

The zoarium has a frontal layer of long tubular zooecia and a basal layer of kenozooecia. The cavities of the kenozooecia are much smaller than those of the autozooecia



Text-fig. 3.—*Mesonea radians* (Lmk.). Part of the basal layer seen by transmitted light after destruction of the autozooecia. *c.p.*, Communication pore. *o.*, Orifice of vacuole. *vac.*, Vacuole. *w.*, Lateral wall of autozooecium.

and, owing to the very thick walls, have the appearance of chambers imbedded in a solid calcareous mass. They are arranged in longitudinal series, and each opens to the exterior by an oval orifice. These are the pores in the dorsal sulci frequently described and figured in *C. radians* (*e. g.* Canu and Bassler, 1920, text-fig. 250, E). Each kenozooecium has a tubular peristome leading inwards from the orifice, at right angles to the dorsal surface of the branch. This opens into a more or less oval chamber placed longitudinally. Each kenozooecium is thus bent at a right angle. The chamber is connected by tubes with its proximal and distal neighbours in the longitudinal series of kenozooecia, and by one or more pores with the adjacent autozooecium (Text-fig. 3). Occasionally the series branch, two kenozooecia springing from the distal end of one.

Canu and Bassler (1920, p. 762) described tergopores in *Mesonea*, but later (1929, p. 549) stated that this was an error. Prof. Canu tells me (in a letter) that the word "vacuoles" should be substituted for "tergopores" in the definition of *Mesonea*. In their definitions of the different types of accessory tube, Canu and Bassler (1920, p. 645) state that adventitious tubes (*i. e.* mesopores, and vacuoles) only arise on the frontal surface, but they have subsequently written of dorsal or posterior vacuoles (*e. g.* *Reteporidea*, 1922, p. 129 : *Mesonea simplex*, 1929, p. 549), so it may be assumed that they do not now regard the frontal or dorsal position as important.

Amathia convoluta, Lamouroux.

Amathia convoluta, Lamouroux, 1816, p. 160 ; Harmer, 1915, p. 64, pl. v, figs. 1–5.

Occurrence.—N.E. Low Is. ; St. II.

Distribution.—E. Australia, Malaya.

This specimen has divided spirals of the *semispiralis* type.

Nolella alta (Kirkpatrick).

Cylindroecium altum, Kirkpatrick, 1888*b*, p. 19, pl. ii, figs. 7, 7*a* ; Whitelegge, 1889, p. 293 ; Harmer, 1915, p. 57 (footnote).

Occurrence.—St. XII.

Distribution.—Port Phillip, Amoy (B.M. 27.8.11.18).

This fragment of a branching *Nolella* consists of three zooecia, and corresponds to Kirkpatrick's description of *Cylindroecium altum*. The larger, more profusely branched specimen from Amoy appears to belong to the same species. The smaller number of tentacles (about 10) together with the branched zooecia distinguishes *N. alta* from *N. papuensis*, in which the zooecia are unbranched and there are about 18 tentacles. The European *Anguinella palmata*, Van Beneden (see Hincks, 1880, p. 539), has 10 tentacles, and appears to be very closely allied to the present species. In specimens in the British Museum the zooecia are thicker and the branching is more profuse.

Valkeria atlantica (Busk).

Farrella atlantica, Busk, 1886, p. 37, pl. vii, figs. 3–3*g*.
Valkeria atlantica, Harmer, 1915, p. 73, pl. vi, figs. 5–12 (references) ; Marcus, 1921*b*, p. 20.

Occurrence.—St. II, XII, XXII.

Distribution.—Malaya, Indian Ocean, Brazil.

Buskia setigera, Hincks.

Buskia setigera, Hincks, 1887, p. 127, pl. xii, figs. 9–13 ; Harmer, 1915, p. 87, pl. v, figs. 8–10 (references) ; Hastings, 1927, p. 351 ; Livingstone, 1927, p. 67.

Occurrence.—N.E. Low Is. ; St. XII.

Distribution.—Queensland, Malaya, China Sea, Indian Ocean.

Aetea anguina (Linnaeus).

Sertularia anguina, Linnaeus, 1758, p. 816.
Aetea anguina, Harmer, 1926, p. 194, pl. xiii, figs. 3, 4 (synonymy); Hastings, 1930*a*, p. 702.

Occurrence.—N.E. Low Is.; St. XII.
Distribution.—Cosmopolitan.

Aetea truncata (Landsborough).

Anguinaris truncata, Landsborough, 1852, p. 288, pl. xvi, figs. 57, 57*.
Aetea truncata, Harmer, 1926, p. 196, pl. xiii, figs. 5–7 (synonymy); Hastings, 1930*a*, p. 702.

Occurrence.—N.E. Low Is.; St. VIII.
Distribution.—Cosmopolitan.

Synnotum aegyptiacum (Audouin).

Loricaria aegyptiaca, Audouin, 1826, p. 243; Savigny, pl. xiii, figs. 4^1–4^5.
Synnotum aegyptiacum, Harmer, 1926, p. 398, pl. xxvii, figs. 3, 4 (synonymy); Osburn, 1927, p. 126; Hastings, 1930*a*, p. 702.

Occurrence.—St. XII, XXII.
Distribution.—W. Atlantic, Mediterranean, Indian Ocean, Malaya, Japan, Victoria, E. Pacific.

Caulibugula dendrograpta (Waters). (Text-fig. 4, A.)

Stirparia dendrograpta, Waters, 1913, p. 470, pl. lxvi, figs. 4–9.
Caulibugula dendrograpta, Harmer, 1926, p. 459, pl. xxxiii, figs. 1–4.

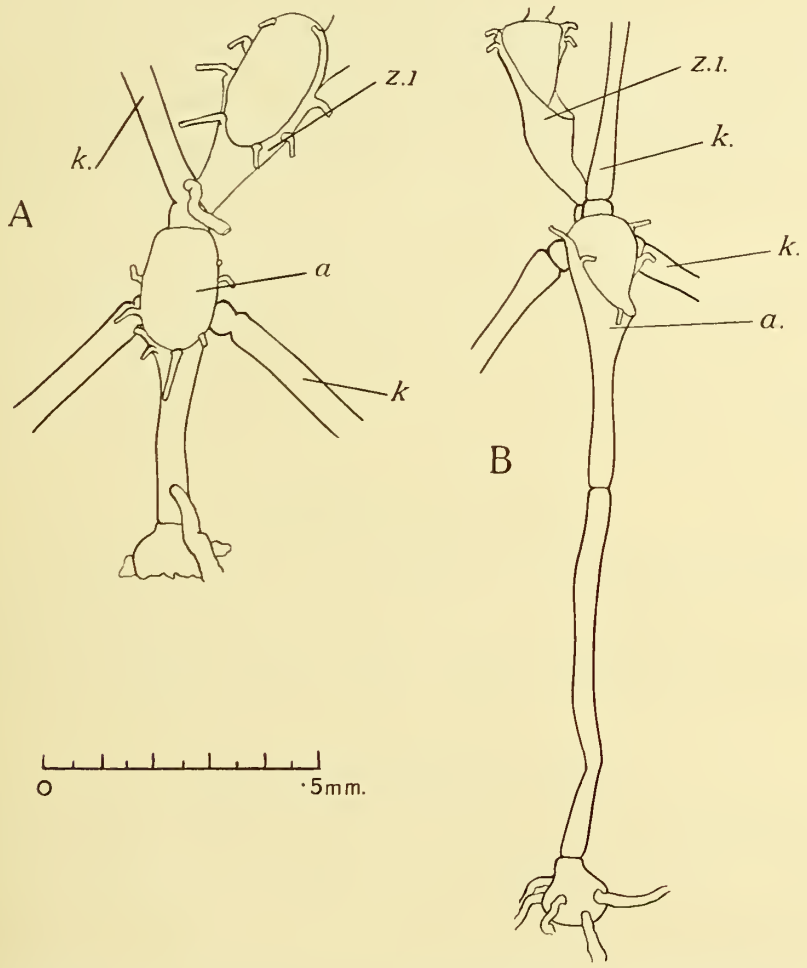
Occurrence.—St. XXI.
Distribution.—Malaya, Zanzibar, Port Phillip.*

This small specimen is part of a young colony. The turbinate ancestrula (Text-fig. 4, A) is attached to the substratum by a slightly spreading base, and by a rootlet springing from the frontal surface near the base. The opesia is oval, and has eight spines on its lateral and proximal borders, but none distally. The ancestrula gives rise to three kenozooecia of typical form, one distal and two lateral, and to the first fan. The primary zooecium of the fan has spines all round the opesia, and arises on the basal surface of the end of the ancestrula, just proximally to the median kenozooecium. This kenozooecium gives rise distally to a series of kenozooecia which may be regarded as the main stalk of the colony, from which fans and kenozooecia are budded laterally. The specimen agrees closely with Harmer's description of *C. dendrograpta*, but there is an avicularium on nearly every zooecium, except the first of a fan and the axillary zooecium at a bifurcation.

From St. XII there is the base of a young colony of another species of *Caulibugula* (Text-fig. 4, B). It resembles *C. zanzibarensis*, Waters (1913, p. 469), in many ways, but, owing to the small size of the specimen and the absence of ovicells and stem-vesicles, the

* Waters (1913, p. 471) states that there is a specimen of this species from Port Phillip in the British Museum. One unnamed *Stirparia* (B.M. 15.10.20.5), from an unknown locality, which was sent by Mr. Waters with some Polyzoa from Zanzibar, proves to be *S. dendrograpta*. Unless this is the specimen from Port Phillip, no specimen from that locality is now in the collection.

species cannot be determined with certainty. The zooecia resemble those of *C. zanzibarensis* in shape and have a proximal avicularium of the kind found in that species, but no spine on the inner distal angle of the opesia. There may be two on the outer angle or none. The ancestrula and the zooecium and kenozooecia budded from it are arranged in the same way as those of *C. dendrograpta*. A kenozooecium appears to have been formed by constriction from the proximal part of the ancestrula, as described in *C. caliculata*



Text-fig. 4.—*Caulibugula*. Base of colony. A, *C. dendrograpta*. B, *Caulibugula*, sp., from St. XII. *a.*, Ancestrula. *k.*, Kenozooecium. *z.*[1]., First zooecium of first fan.

by Levinsen (1909, p. 102, pl. iii, figs. 1*d*, *e*). The ancestrula and first zooecium differ in the two species in the same way as do the adult zooecia, the opesia being more or less oval in *C. dendrograpta* and almost triangular in the unnamed species.

Beania regularis, Thornely.

Beania regularis, Thornely, 1916, p. 161, text-fig. 6 ; Harmer, 1926, p. 418, pl. xxviii, figs. 11, 12 (synonymy).

Occurrence.—N.E. Low Is. ; St. IX, XII.

Distribution.—Holothuria Bank, N.W. Australia (B.M. 92.1.28.35) ; Malaya ; Indian Ocean.

Nellia oculata, Busk.

Nellia oculata, Busk, 1852*b*, p. 18; Harmer, 1926, p. 240, pl. xiv, fig. 18, text-figs. 3B, D, 4A, B (synonymy); Livingstone, 1927, p. 52; Osburn, 1927, p. 125; Canu and Bassler, 1928*b*, p. 26.

Occurrence.—W. Low Is., 6 fath.; St. IX, XII, XXI, XXII.

Distribution.—Australia, Malaya, Amoy (B.M. 27.8.11.15), Indian Ocean, E. Atlantic.

A specimen of the typical form is in a collection sent to the British Museum from Amoy in 1926 by Dr. C. Ping, and this collection also includes var. *quadrilatera*. The Barrier Reef collection only contains the typical form.

From St. XXI there are several small complete colonies attached to discoidal Foraminifera from the surface of a sponge. The Polyzoa are slung by a number of rootlets, the proximal zooecium not being in contact with the substratum.

Didymozoum triseriale (Philipps).

Didymia triserialis, Philipps, 1899, p. 442, pl. xlii, figs. 2, 2*a*.
Didymozoum triseriale, Harmer, 1926, p. 407, pl. xix, fig. 1.

Occurrence.—St. XXII.

Distribution.—Malaya, Oceania.

Retiflustra cornea (Busk).

Retepora cornea, Busk, 1852*a*, p. 380.
Retiflustra cornea, Harmer, 1926, p. 250, pl. xv, fig. 3, text-fig. 8 (synonymy).

Occurrence.—St. VIII.

Distribution.—N. Australia, Malaya (Aru Is., New Guinea).

Scrupocellaria maderensis, Busk.

Scrupocellaria maderensis, Busk, 1860, p. 280; Harmer, 1926, p. 372, pl. xxv, figs. 16–19 (synonymy).

Occurrence.—N.E. Low Is.

Distribution.—Malaya, Japan, Indian Ocean, E. Atlantic, W. Atlantic (B.M. 31.12.19.5, Tortugas).

Scrupocellaria diadema, Busk.

Scrupocellaria diadema, Busk, 1852*a*, p. 370; Harmer, 1926, p. 375, pl. xxv, figs. 20–25 (synonymy); Livingstone, 1927, p. 52; Canu and Bassler, 1929, p. 211, pl. ix, figs. 4, 5.

Occurrence.—N.E. Low Is.; St. II, VIII, XII.

Distribution.—Australia, Malaya, Japan, Indian Ocean.

Scrupocellaria delilii (Audouin).

Crisia delilii, Audouin, 1826, p. 242; Savigny, pl. xii, figs. 3^1–3^5.
Scrupocellaria delilii, Harmer, 1926, p. 370, pl. xxv, figs. 12–15 (synonymy).
Scrupocellaria macandrei, Livingstone, 1927, p. 53.

Occurrence.—W. Low Is., 6 fath.; St. IX, XII.

Distribution.—Australia, Malaya, Japan, Red Sea, Mediterranean, Madeira.

Scrupocellaria spatulata (d'Orbigny).

Cellularia spatulata, d'Orbigny, 1851, p. 50.
Scrupocellaria spatulata, Harmer, 1926, p. 382, pl. xxvi, figs. 1–10 (synonymy).
Scrupocellaria cervicornis (pars), Livingstone, 1927, p. 53.

Occurrence.—St. XII.

Distribution.—E. Australia, Malaya, Indian Ocean, Florida.

Two small pieces agree with Harmer's description of *S. spatulata* in the form of the zooecia, the number and position of spines, the form and position of vibracula and scuta and in the barbed rootlets. Ovicells, frontal avicularia and enlarged marginal avicularia are absent, but the agreement in the other characters is so close that the identification is made with fair confidence. One piece includes the ancestrula, which has the form frequently found in cellularine Polyzoa (*e. g.* Busk, 1852*b*, pl. xxiii, fig. 1 ; Hastings, 1930*a*, pl. i, figs. 1 and 4) and has eleven spines evenly distributed round the opesia.

Caberea lata, Busk.

Caberea lata, Busk, 1852*a*, p. 378 ; Harmer, 1926, p. 360, pl. xxiv, figs. 7–9 (synonymy) ; Livingstone, 1927, p. 53.

Occurrence.—St. XII.

Distribution.—Queensland, Malaya, Japan, Indian Ocean.

Caberea boryi (Audouin).

Crisia boryi, Audouin, 1826, p. 242 ; Savigny, pl. xii, figs. 4^1–4^6.
Caberea boryi, Harmer, 1926, p. 362, pl. xxiv, figs. 13–15.

Occurrence.—St. IX, XII.

Distribution.—Malaya, Japan, Indian Ocean, Mediterranean.

Caberea transversa, Harmer.

Caberea transversa, Harmer, 1926, p. 363, pl. xxiv, figs. 5, 10 ; Canu and Bassler, 1929, p. 214, pl. xxxviii, figs. 9, 10.

Occurrence.—St. XII.

Distribution.—Malaya.

Harmer mentions the relationship of his species to the Australian *C. glabra*, Macgillivray (1886, p. 129), which differs in its large spines and frontal avicularia. In specimens of *C. glabra* in the British Museum the large spines are not present on all parts of the colony. It would not be easy to distinguish such spineless parts from *C. transversa*, and the occurrence of both species on the Australian coast suggests that they may be synonymous.

Acanthodesia savartii (Audouin).

Flustra savartii, Audouin, 1826, p. 240 ; Savigny, pl. x, figs. 10^1, 10^2.
Acanthodesia savartii, Harmer, 1926, p. 213, pl. xiii, figs. 8, 13, 14, 16 (synonymy) ; Livingstone, 1927, p. 54 ; Canu and Bassler, 1929, p. 66, pl. i, figs. 1–5.

Occurrence.—Low Is., 12 fath. ; St. XIII.

Distribution.—Australia, Malaya, Japan, Indian Ocean, Morocco, Florida.

Chaperia acanthina (Lamouroux).

Flustra acanthina, Lamouroux, 1825, p. 605, pl. lxxxix, figs. 1, 2.
Chaperia acanthina, Harmer, 1926, p. 229, pl. xiv, figs. 9, 10 (synonymy); Livingstone, 1927, p. 54; 1929, p. 100; Canu and Bassler, 1929, p. 472, text-figs. 201D–G, 202.

Occurrence.—St. II.

Distribution.—Australia, New Zealand, Malaya, Indian Ocean, Falkland Islands.

This young colony consists of the ancestrula and first three zoecia, but they show the characters of the species and can be identified with fair confidence.

Setosellina coronata (Hincks).

Membranipora coronata, Hincks, 1881*b*, p. 147, pl. x, fig. 1.
Setosellina coronata, Harmer, 1926, p. 265, pl. xvi, figs. 2–4 (synonymy).
Ellisina coronata, Livingstone, 1927, p. 54.

Occurrence.—St. XXII.

Distribution.—Australia, Malaya, Indian Ocean.

The specimen was dead when collected and only the calcareous parts remain. These are, however, sufficiently characteristic for determination.

Cupuladria guineensis (Busk).

Cupularia guineensis, Busk, 1854, p. 98, pl. cxiv.
Cupuladria guineensis, Harmer, 1926, p. 266, pl. xvi, figs. 5–7, text-fig. 9 (synonymy).
Cupuladria guineensis, *intermedia* and *brevipora*, Canu and Bassler, 1929, p. 74.

Occurrence.—Low Is., 12 fath.

Distribution.—Australia, Malaya.

Canu and Bassler (1929, p. 74) introduce new names for species identified as *Cupuladria guineensis*, Busk, as follows:

C. guineensis, Busk, 1854, type of the species.
,, ,, 1884 = *C. intermedia*, Canu and Bassler, 1929.
,, Harmer, 1926 = *C. brevipora*, ,, ,,

Their conclusions are based on the published figures and descriptions, some of which are misleading, as examination of the original specimens in the British Museum shows. Busk's figure of the holotype (1854, pl. cxiv, fig. 3) gives an impression of a tuberose basal surface, and for this reason Canu and Bassler regard the later specimens, which have a pitted basal surface, as distinct. The specimen figured by Busk has, however, a pitted basal surface. Some of the pits have slightly raised borders, but the majority form no projection at all. All three specimens thus agree in having a pitted basal surface. Canu and Bassler would further distinguish *C. guineensis*, Harmer, 1926, from the others on the shape of the opesia. The fact is, however, that Harmer gave the first adequate account of the variation in the form of the opesia, and that the various shapes mentioned by him are found in all the specimens.

Canu and Bassler maintain the separation of *C. stellata* (Busk, 1854). Busk distinguished the species by the serrate edge of the colony and the narrow smooth cryptocyst. Each serration consists of the distal part of one zooecium with its distal

vibraculum. These do not project any more than in other species of *Cupuladria*, but owing to the small size of the colonies they are more conspicuous. The stellate appearance of the colony can thus be regarded as characteristic of young colonies. The cryptocyst is rather narrow in the type-specimen and descends steeply. It is tuberculate, as in *C. guineensis*. The basal surface of the figured type-specimen is not smooth, as in Busk's figure, but roughened and pitted. It has not, however, the conspicuously tuberose surface of *C. dentifera*, Canu and Bassler (1929, p. 75). The differences between *C. guineensis* and *C. stellata* are thus slight, and I agree with Marcus (1921*b*, p. 8) and Harmer (1926, p. 266) that *C. stellata* is a young colony of *C. guineensis*.

Steganoporella buskii, Harmer.

Steganoporella buskii, Harmer, 1900, p. 272, pl. xii, fig. 13; pl. xiii, figs. 33–35; 1926, p. 279 (references); Livingstone, 1927, p. 56.

Occurrence.—Low Isles (shore).

Distribution.—Australia, Malaya, Indian Ocean.

These specimens are encrusting. There is slight variation in the sclerites of the B-opercula, their parallel portions sometimes being shorter than in that figured by Harmer, but the majority are typical. Similar slight variability is found in most of the specimens in the British Museum identified with this species by Harmer.

Thalamoporella rozieri (Audouin).

Flustra ? rozieri, Audouin, 1826, p. 239; Savigny, pl. viii, figs. 9^1, 9^2.
Thalamoporella rozieri, Harmer, 1926, p. 292, pl. xix, figs. 3–13 (synonymy); Livingstone, 1927, p. 56.

Occurrence.—Batt Reef.

Distribution.—Australia, Malaya, Indian Ocean, Cape Verde Is., S.W. England.

Cellaria punctata (Busk).

Salicornaria punctata, Busk, 1852*a*, p. 366.
Cellaria punctata, Harmer, 1926, p. 337, pl. xxi, figs. 14–16, text-fig. 13*a* (synonymy).
Cellaria gracilis, Livingstone, 1927, p. 57.

Occurrence.—St. II.

Distribution.—E. and N.E. Australia, Malaya, Indian Ocean.

Hippopodina feegeensis (Busk).

Lepralia feegeensis, Busk, 1884, p. 144, pl. xxii, fig. 9; Livingstone, 1926*a*, p. 94.
Lepralia feegensis, Waters, 1913, p. 514, pl. lxx, figs. 21, 22 (references).
Cosciniopsis fallax, Canu and Bassler, 1929, p. 276, pl. xxviii, fig. 7, text-fig. 113A–D.
? not *Hippopodina feegeensis*, Levinsen, 1909, pl. xxiv, fig. 3*a*, *b*.
? not *Hippopodina feegensis*, Hastings, 1930*a*, p. 729.

Occurrence.—St. XIII.

Distribution.—Australia, Malaya, Indian Ocean.

Busk described the ovicells of this species as inapparent, and this has led some authors to the belief that the true *H. feegeensis* has endozooecial ovicells. Canu and Bassler introduced the name *Cosciniopsis fallax* for the supposedly distinct form with large ovicells. Busk's type-specimen has, however, large ovicells exactly like those figured in *C. fallax* and there can be no doubt that *C. fallax* is a synonym of *H. feegeensis*.

Since *L. feegeensis*, Busk, is the genotype of *Hippopodina*, Levinsen (1909, p. 353), the presence of large, hyperstomial ovicells invalidates the expanded definition of the genus given by Canu and Bassler (1920, p. 532).

The specimens from Gorgona (Hastings, 1930*a*) resemble those figured by Levinsen (1909, pl. xxiv, fig. 3*a*, *b*) in the shorter avicularia and smaller, more immersed ovicells ; the ovicells being ·4 to ·45 mm. wide and those of the type ·76 mm. Levinsen's specimens came from St. Thomas, W. Indies, and it seems possible that the American form is distinct from the Indo-Pacific one, though Osburn (1927) had specimens with long and short avicularia from Curaçao. The Pliocene specimens from Bocas Island, Panama (Canu and Bassler, 1928*b*, p. 133) appear, however, to be of the typical form.

Lepralia montferrandii (Audouin).

Flustra montferrandii, Audouin, 1826, p. 240 ; Savigny, pl. ix, figs. 14^1, 14^2.
Lepralia montferrandii, Waters, 1909, p. 171, pl. xvii, figs. 15–18 (synonymy).

Occurrence.—St. XIII.

Distribution.—Queensland, Port Phillip Heads (B.M. 88.11.14.317), Tizard Bank (B.M. 89.8.21.103, 104), Ceylon, Red Sea.

I have examined the specimen from the Red Sea identified with Audouin's species by Waters. It much resembles the Barrier Reef specimen. The orifice of the former is on the average broader in its proximal part, with a straighter lower lip, but there is variation in both specimens. The spatulate avicularium of that from the Red Sea is smaller and more oblique, and the thickened border of the operculum is conspicuous owing to its brown colour. Waters regarded the Queensland species, which is very probably *L. mortoni*, Haswell (1881, p. 40), as identical with that from the Red Sea, and in spite of their slight differences I am inclined to agree with him. Livingstone (1927, p. 63) recorded both species from Queensland.

Thornely (1905, p. 119) recorded *L. mortoni* from Ceylon. Part of her specimen is in the Cambridge Museum and is referable to *L. montferrandii*. The specimen from the same locality identified by Waters (1909, p. 171) with *L. montferrandii* has been lent to me and is a distinct species. As mentioned by Waters, the frontal wall has marginal areolae and a central imperforate area, and the peristome is somewhat raised.

A number of species resembling *L. montferrandii* have been named, and it is uncertain how many of them are really distinct. A specimen from Japan in the Cambridge Museum identified, probably correctly, with *L. acuta*, Ortmann (1889, p. 41), is very similar, but has the proximal end of the oblique spatulate avicularium in the middle of the zooecium, that of *L. montferrandii* being more lateral—a very slight distinction. A specimen of *L. obtusata*, Ortmann (1889, p. 41), from Japan in the Cambridge Museum has all the avicularia obtuse and median. The large, spatulate ones may be longitudinal or very slightly oblique. Other species of this group are *L. anatina* (Canu and Bassler, 1927*b*, p. 26) from Hawaii and *L. granulata* (Canu and Bassler, 1930, p. 29 ; Hastings, 1930*a*, p. 725) from the Galapagos Islands.

These forms agree in having a uniformly punctured frontal wall, an ovicell uniformly, but rather less closely punctured, a median, backwardly-directed avicularium on most of the zooecia, a more or less round orifice, and (where it has been examined) an operculum with a pair of articular projections (Waters, 1909, pl. xvii, fig. 16 ; Hastings, 1930*a*,

pl. xiii, fig. 83). In these characteristics they agree with *Lepralia galeata*, Busk (1854,* p. 66), the genotype of *Codonella*, a genus introduced by Canu and Bassler (1927*b*, p. 26) for this group of species. The name *Codonella* cannot stand, however, having been used by Haeckel (1873, p. 564) for a genus of Infusoria. Pending the introduction of another name it has seemed convenient to put them into *Lepralia*, used, as proposed by Canu and Bassler (1927, p. 32), as a temporary name for unplaced species.

Comparison of the type-specimen of *L. galeata* with Calvet's description of *L. gemelliporoides* (1904, p. 23) shows that they are synonymous, as maintained by Waters (Calvet, 1904, p. 24). *L. galeata*, Busk (1879, p. 195), from Kerguelen, appears to be distinct, having the central part of the frontal wall imperforate and having marginal areolae, an operculum of a different shape, and a considerably raised avicularium with a larger, more spatulate mandible.

Schizomavella.

Two species in the collection, *S. lata* and *S. australis*, with *S. triangula* (Hincks, 1881*c*, p. 12) and *S. ambita* (Waters, 1889, p. 11), must probably be separated from *Schizoporella*, Hincks (1877, p. 527), genotype *S. unicornis*, Johnston.† Waters (1904, p. 49) defined several groups of Schizoporellid species. He expressed the opinion that the group containing *S. lata*, *S. triangula* and *S. ambita* deserved generic rank, and suggested the use of *Gemellipora*, Smitt (1873, p. 35). According to Canu and Bassler (1928*b*, p. 151) he made *G. glabra* the genotype. As I understand him, his intention was not to select *G. glabra*, which he never mentions, but to point out that if " the first species mentioned by Smitt " (*i. e. G. eburnea*, which he thus clearly regards as the genotype) should be a *Pasythea*, the name *Gemellipora* would be synonymous with *Pasythea*, and not available for Smitt's other species and their congeners. *G. eburnea* is the only species included in the genus by Levinsen (1909, p. 313), and even if the virtual selections of Smitt himself (quoted by Canu and Bassler, 1928, p. 151, footnote) and of Waters are not accepted, Levinsen's selection is valid, and has priority over the selection of *G. glabra* by Canu and Bassler (1920, p. 369). As pointed out by Canu and Bassler (1928*b*, p. 151), Macgillivray (1895, p. 87) and Maplestone (1902, p. 71) both used *Gemellipora*. They did not, however, express an opinion on the genotype. *S. lata*, and its allies do not appear to have any special relationship to *G. eburnea*, and cannot be put in *Gemellipora*.

A glance at the figures of *S. auriculata* (Hassall), reproduced by Canu and Bassler (1920, p. 354, text-figs. 107 F, G), will show that there is not complete agreement as to the shape of the orifice. Examination of the British specimens in the British Museum and comparison with Johnston's figure (1847, pl. liv, fig. 8, which, according to Hassall, 1842, p. 411, was to be furnished by him) and of Hincks (1880, pl. xxix, figs. 3–5), satisfies

* The date 1852 given by Canu and Bassler is that of Vol. I of the British Museum Catalogue, but *L. galeata* is described in Vol. II.

† Waters (1904, p. 49) overlooked Hincks's selection, and assumed that *S. sanguinea* or *S. linearis* included in the genus by Hincks (1879, p. 157) would be the genotype. His *Schizoporella*, s. str., is not, therefore, the group of species to which the name really belongs. He repeats this mistake in 1913 (p. 505).

Canu and Bassler (1920, p. 335) have also overlooked Hincks's selection, but mention *S. unicornis* as the first species described. They introduce *Schizopodrella* with *S. unicornis* as genotype, and propose to use *Schizoporella*, " at least provisionally, for all the species imperfectly studied and classed." The convenience of a miscellaneous genus of this kind is obvious, but the use of a name that has been properly introduced with a well-known species as genotype, and the introduction of another genus with the same genotype cannot be accepted. *Schizoporella* and *Schizopodrella* are therefore regarded as synonymous.

me that the true *S. auriculata* has an orifice resembling that of the ordinary zooecia of *S. lata* and *S. triangula*. This shape is difficult to define briefly and accurately, but, seeing text-fig. 5 A, the description " roundly triangular," used in this paper, will be readily intelligible.

S. triangula and its allies appear to be so closely related to *S. auriculata* (see also p. 418) that, in spite of the opercular dimorphism, they should be regarded as congeneric. They agree in the more or less uniform perforation of the frontal wall and ovicell (the latter sometimes being partially covered by an imperforate crust formed by secondary calcification) ; in the shape of the orifice of the ordinary zooecium ; in the attachments of the occlusor muscles of the operculum, which are near the margin and connected to it by a little sclerite ; in the median avicularium just proximal to the orifice. The very different degree of dimorphism found in these species (*e.g.*, the slight dimorphism of *S. lata*) supports the view, already expressed by Waters (1918*b*, p. 99), that dimorphism of the opercula is not a generic character. As *S. auriculata* is the genotype of *Schizomavella*, Canu and Bassler (1917, p. 40), the most satisfactory course seems to be to put *S. triangula* and its allies in this genus. As pointed out by Livingstone (1929, p. 80), the genus *Metroperiella*, Canu and Bassler (1917, p. 40), in which *S. lata* has sometimes been placed, is now merged in *Schizomavella*.

Though all the species of *Schizomavella* here discussed have a roundly triangular orifice, no implication that species with a differently shaped orifice should be excluded is intended.

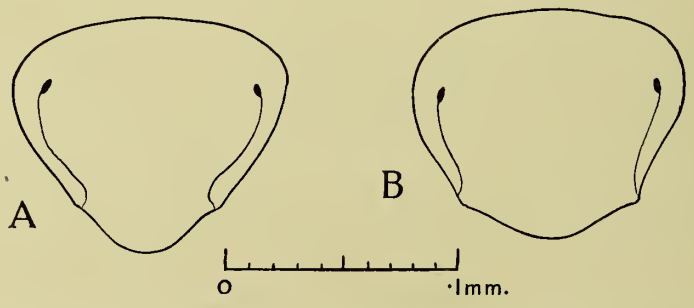
Schizomavella lata (Macgillivray). (Text-fig. 5.)

Schizoporella lata, MacGillivray, 1883, p. 132, pl. i, fig. 7 ; Waters, 1889, p. 10.
Schizoporella (*Metroperiella*) *lata*, Livingstone, 1929, p. 79 (references).
? *Schizoporella auriculata*, Kirkpatrick, 1890*a*, p. 617.

Occurrence.—St. XIV.

Distribution.—Australia, New Zealand.

There is one small colony which must be identified with Macgillivray's species. The colony is young, and is still very transparent and delicately calcified. There is a small



Text-fig. 5.—*Schizomavella lata* (Macg.). Operculum of ordinary zooecium (A) and fertile zooecium (B).

raised, triangular avicularium on the frontal wall proximal to the orifice and directed obliquely backwards. The opercula of the ordinary zooecia are roundly triangular; those of the fertile zooecia are more quadrangular (Text-fig. 5, A, B). The ovicell is uniformly punctured. The condyles are denticulate.

The avicularia of the Tertiary form figured by Macgillivray (1895, pl. xi, fig. 5)

resemble those of *S. triangula*, described below (pp. 417–418), rather than those of *S. lata*. It is impossible without examining the specimens to tell whether *S. lata*, Thornely (1912 p. 148), is Macgillivray's species or not.

The specimen from Torres Straits, identified by Kirkpatrick (1890*a*, p. 617) with *S. auriculata*, is only represented in the British Museum by a preparation of the chitinous parts (B.M. 32.2.2.2), but the possession of two types of opercula, identical in form with the corresponding opercula of *S. lata*, proves it to have been, as was surmised by Kirkpatrick, a specimen of that species rather than *S. auriculata*. The majority of the mandibles are pointed, but a few are semicircular.

S. lata is closely allied to *S. ambita*, Waters (1889, p. 11). The ovicell of *S. ambita* is larger and flatter and an imperforate crust grows up round it. The orifice of the fertile zooecium is larger, corresponding to the large ovicell. The avicularium is very small in both.

Schizomavella australis (Haswell). (Pl. I, fig. c.)

Hemeschara australis, Haswell, 1881, p. 41, pl. ii, figs. 7, 8.
Schizoporella australis, Harmer, 1902, p. 303, pl. xvii, fig. 47 ; Livingstone, 1927, p. 61.

Occurrence.—N.E. Low Is. ; Low Is., 12 fath.

Distribution.—Queensland, Port Darwin, 8–12 fath. (B.M. 82 . 2 . 23 . 511) ; Holothuria Bank, N.E. Australia, 9–36 fath. (B.M. 92.1.28.75) ; Saghalien, Japan (B.M. 62.7.16.3) ; Singapore (B.M. 86.10.19.1–3).

There can be no doubt of the identity of these specimens with *S. australis*. I have compared them with part of Haswell's material and with Harmer's specimen from Torres Straits, both belonging to the Cambridge Museum.

The colonies (Pl. I, fig. c) have the branched and anastomosing tubular structure figured by Haswell. There is, however, some variation, for the two pieces from the Holothuria Bank are more slender, more irregularly and profusely branched, and show a greater tendency to the formation of irregular superficial layers. In zooecial characters they are indistinguishable from the other specimens. The colony from Port Darwin is complete basally and is attached to a stone by an extensive encrustation, consisting of autozooecia like those forming the erect parts.

There is a good deal of variation in the development of the narrow raised lines outlining the zooecia. In extreme cases they may be conspicuous all round the zooccia or entirely absent. The orifices of the non-fertile zooecia vary very slightly in the depth of the sinus, the opercula varying correspondingly. The orifices of the fertile zooecia are distinctly broader, though the difference is not so pronounced as in some allied species (*e. g. S. ambita* and *S. triangula*). The ovicell is hyperstomial and closed by the operculum. It is flat frontally and sunk in the distal zooecium, and is therefore not very prominent, though, being as wide as the zooecium, it is large. Its sculpture is like that of the frontal wall.

The mandible of the large, proximally directed, frontal avicularia lies, when open, right back against the frontal wall and fits into a groove, which has a rounded end and is fairly uniform in width. These avicularia are only found on some zooecia. Some have no avicularia, and others have a small median one on the proximal side of the orifice directed obliquely towards the distal end of the zooecium. These small avicularia resemble the large ones in having a mandible which lies in a groove when open. *S. triangula* also

has a depressed area of the frontal wall proximal to the avicularium, and corresponding in shape to the mandible, which rests in it when open.

In a decalcified and stained preparation the oral glands are rather conspicuous. The polypides are only remarkable for the cæcum, which is sharply defined and very little longer than broad.

S. machaira, Marcus (1922, p. 436), appears to be allied to this species. It differs chiefly in the small number of large irregular pores in the ovicell. The two teeth on the mandible were not seen in *S. australis*. The absence of oral glands in *S. machaira* may only be a seasonal difference.

It seems possible that *S. australis* may, like *S. lata*, and perhaps *S. triangula*, sometimes have been confused with *S. auriculata*. A specimen sent by the Australian Museum as *S. auriculata* proves to be *S. australis*. I have seen no undoubted specimen of *S. auriculata* from Australia. That of Hincks (1880, p. 263) from Glenelg (B.M. 99.5.1.988) is very small and without ovicells, and might equally well be another species of this group.

Emballotheca, sp. (Text-figs. 6, A, 7.)

Occurrence.—St. XII, XXII. Prince of Wales Channel, Torres Straits, 4 fath. (B.M. 82.2.23.82, 525); Murray Island, Torres Straits (B.M. 90.7.23.53); Torres Straits, 10 fath. (B.M. 82.2.23.411); Torres Straits (Cambridge Museum, Coll. Haddon); Port Molle, Queensland (B.M. 81.10.21.5).

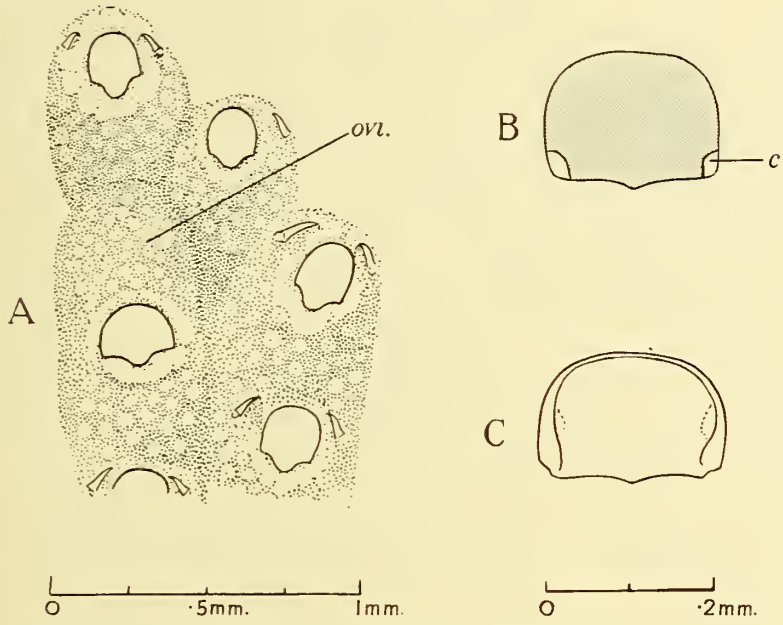
Description.—The zoarium is encrusting or erect and unilaminar or tubular. The zooecia are usually more or less rectangular and arranged regularly, but a superficial layer of irregular zooecia may be formed. The frontal wall and ovicell are uniformly punctured with rather large pores, and there may be some nodular thickening round the orifice (Text-fig. 6, A). The ovicell is large and deeply immersed. The orifice of the non-fertile zooecium is longer than broad; that of the fertile zooecium is broader than long. On many zooecia there is a small avicularium in each distal corner. This avicularium is directed towards the median line on the distal side of the orifice. The beak is somewhat raised and the mandible is narrow and acute. The operculum of the non-fertile zooecium has a thickened border forming a flange on each side to which the occlusor muscles are attached, and sockets at the proximal corners for articulation to the condyles (Text-fig. 7, A). The operculum of the fertile zooecium (Text-fig. 7, B) has a strong sclerite, which is marginal proximally, but round the curved border is a little distant from the edge. Irregularly lobed processes, which appear to be chitinous, project from the distal part of the sclerite.

Remarks.—I have been unable to recognize this species with certainty in any description, but there are several more or less resembling it, so I hesitate to name it as new.

From its occurrence on the Queensland coast and in Torres Straits its presence in Haswell's collection is probable, and there are two species briefly described and not figured by Haswell (1881, p. 39) which somewhat resemble it, namely, *Lepralia*, sp., and *L. assimilis*. The former seems nearer to it, but both are described with a narrow sinus.

Schizoporella subsinuata, Marcus (1921*b*, p. 16), is similar. The distal avicularia are mentioned by Marcus, though not present on the figured zooecia. The ovicells in Marcus's fig. 8*a* are more prominent, and in fig. 8*c* their pores are shown as still clearly visible after decalcification, and the opercula differ slightly in shape. There can be no doubt that

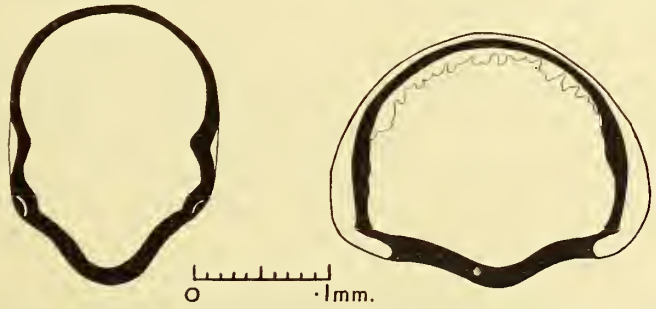
Marcus had not got *S. subsinuata*, Hincks (1884*b*, p. 280). Hincks figured a specimen with a wide, roughly rectangular orifice with a notch in the proximal border, and his figure is accurate, for some specimens, such as those from Port Phillip (B.M. 88.11.14.414; 97.5.1.767, 827), agree with it exactly. Others have the proximal border, in at least



Text-fig. 6.—A, *Emballotheca*, sp. Dry specimen with ectocyst intact. B and C, *Schizoporella subsinuata*, Hcks., from Port Phillip. B, Orifice. C, Operculum. *c.*, Condyle. *ovi.*, Ovicell.

some zooecia, straight or slightly curved, but not notched. All agree in the general shape of the orifice and of the thick condyles in the proximal corners (Text-fig. 6, B). The operculum (Text-fig. 6, C) is very different from that of Marcus's species.

Other species more or less resembling the Barrier Reef species are described by Canu and Bassler (1929, pp. 297–302) under *Emballotheca*. Of these, *E. capitifera* is probably



Text-fig. 7.—*Emballotheca*, sp. Operculum of ordinary zooecium (A) and fertile zooecium (B).

the nearest, but it differs in the shape of the operculum and in the presence of vicarious and absence of adventitious avicularia.

The attribution of the present species to *Emballotheca*, Levinsen (1909, p. 333), is in accordance with Levinsen's conception of the genus, both *E. furcata* (see footnote, p. 422) and *E. subimmersa* appearing to be allied species. It is, however, unlikely that any of

these three species should be regarded as congeneric with *E. quadrata*, the genotype (Canu and Bassler, 1920, p. 366), which differs in the large curved teeth in the orifice, in the convex proximal border of the orifice and in the operculum.

Stylopoma. (Text-fig. 8.)

The genotype of *Stylopoma* is the W. Indian species figured by Levinsen (1909, pl. xviii, figs. 4 *a–c*), this being clearly the species intended by Canu and Bassler (1920, p. 359), for in repeating their selection (1923, p. 101) they reproduced Levinsen's figures. They showed their specimens from the Gulf of Mexico (1928*b*, p. 92, text-fig. 14 B) with a more uniformly tapering tongue to the operculum and no denticles in the aperture. In the first point at least the specimens of Smitt (1873, p. 42) agreed with Levinsen's, for the sinus was " proximally a little dilated." Specimens from the Tortugas (B.M. 31.11.19.22) and the Galapagos Islands (Hastings, 1930*a*, p. 721) agree with Levinsen's figure and description.

The characters of the genotype of *Stylopoma* are, therefore, sufficiently clearly defined, but the name *E. spongites*, Pallas (1766, p. 45), is not available for it, for Pallas almost certainly confused two species, one from the Mediterranean, to which the name should be restricted (Harmer, 1930, p. 80), and one from America, which is probably the well-known West Indian *Stylopoma*. Canu and Bassler (1923, p. 102) suggested that the name *S. informata* (Lonsdale, 1845, p. 505) could be used for the latter species, and this course has been adopted here.

An ovicellular operculum like that described below (p. 425) is present in all forms of *Stylopoma* examined by me, and may be a generic character.

A tendency to chitinization of the ectocyst round the orifice has been noticed in several of the forms examined, and, as it is almost impossible to separate the operculum completely, it is often difficult to decide which of the visible lines is its true proximal border. The outlines here given have been obtained by careful comparison of decalcified specimens stained with borax-carmine and picric acid, both mounted whole and teased apart, with undecalcified specimens cleared and mounted whole and crushed to separate the opercula. It is possible that the disc-like tip of the tongue (Text-fig. 8, G, K) may not be truly part of the operculum, but it certainly appears to be.

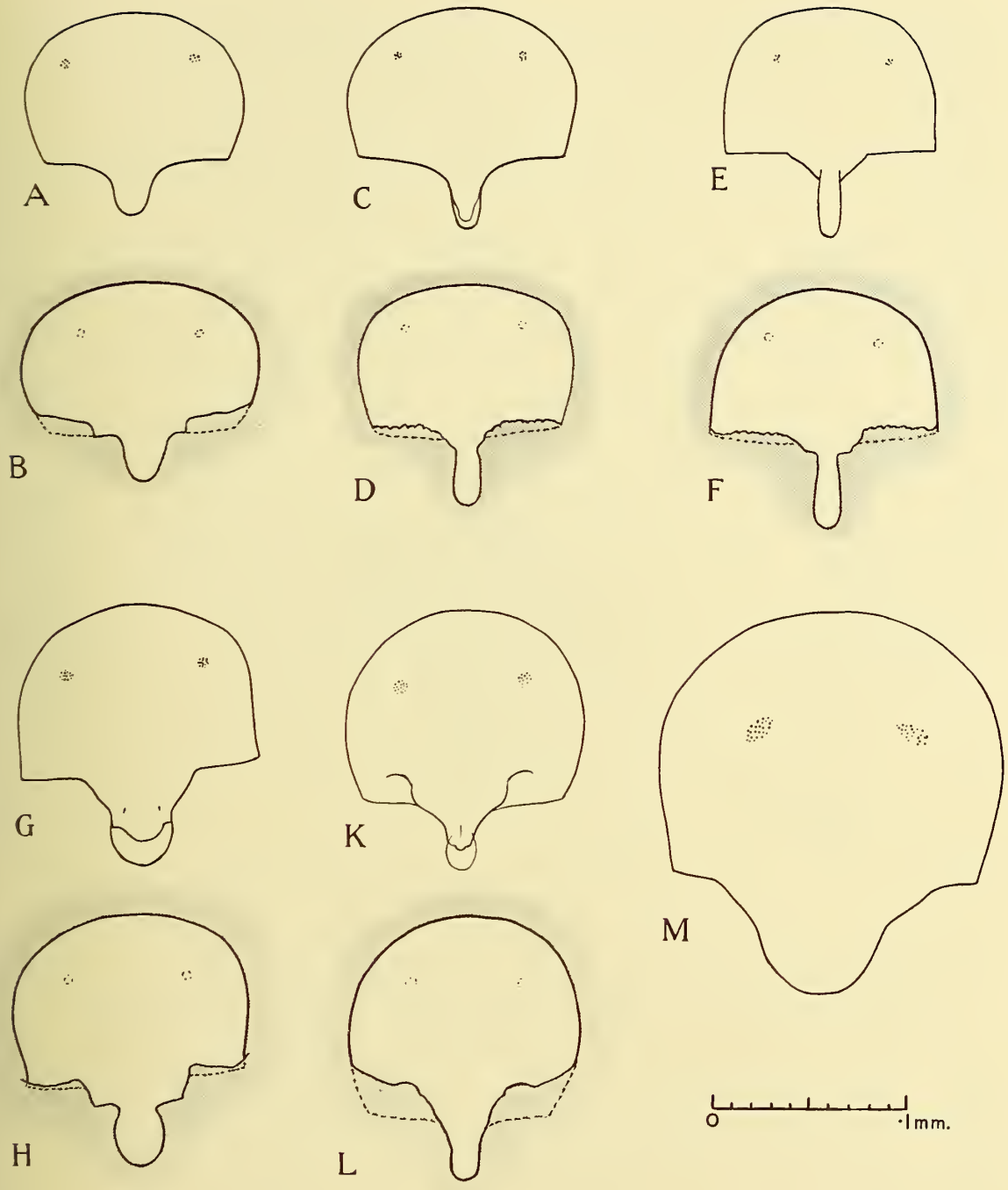
The orifice in *S. informata* (Text-fig. 8, G, H) and *S. schizostoma* (Text-fig. 8, A–F) is more or less semicircular, with a median sinus in the straight proximal margin. The straight edge on each side of the sinus bears a flat plate, which joins the lateral border of the orifice, but may not reach the corner of the sinus (Text-fig. 8, B, H). The edge of the operculum overlaps this plate, which clearly corresponds to the condyle or hinge-tooth in other forms and is here called the condyle.

Stylopoma schizostoma (MacGillivray). (Text-figs. 8, A–F, 9.)

Lepralia schizostoma, MacGillivray, 1868, p. 135.
Schizoporella schizostoma, Macgillivray, 1889, p. 28.
Stylopoma parviporosa, Canu and Bassler, 1929, p. 315, pl. xxxvi, figs. 3–6, text-fig. 131B.

OCCURRENCE.—St. XII, XIII.

DISTRIBUTION.—S. Australia; Victoria; Murray Island, Torres Straits (B.M. 31.9.11.14, 90.3.24.18); West Island, Torres Straits, 17 fath. (B.M. 82.2.23.535); Clairmont Island, N.E. Australia, 11 fath. (B.M. 82.2.23.551); Holothuria Bank, N.W.



Text-fig. 8.—*Stylopoma.* Operculum alone and orifice with operculum in position of: A–F, *S. schizostoma* (Macg.); A, B, from Barrier Reef; C, D, from Fort Phillip; E, F, from Torres Straits. G. H, *S. informata* (Lonsd.), from Galapagos. K, L, *Stylopoma*, sp., from Mascarenes. M, Operculum of *S. viride* (Thorn.). Calcareous parts stippled. Portions of opercula overlying calcareous parts shown by dotted lines.

Australia, 34 fath. (B.M. 92.1.28.43); Amboyna (B.M. 84.2.22.3); New Harbour, Singapore, 7–10 fath. (Cambridge Museum, Coll. Hanitsch); Papeete, Tahiti (B.M. 29.4.25.4); Tizard Bank (B.M. 89.8.21.80); Philippines.

As represented by specimens from Port Phillip in the Bracebridge Wilson Collection (B.M. 97.5.1.763, 764), *S. schizostoma* has a rather narrow sinus and denticulate condyles (Text-fig. 8, C, D). In the specimen from West Island the sinus is longer and narrower (Text-fig. 8, E, F) and the tongue of the operculum is strongly arched, following the contour of the frontal wall, which descends rather steeply to the proximal border of the orifice. As in the Port Phillip specimen, the condyles are toothed. Their surface is ridged and the ectocyst between these ridges is chitinized, so that in preparations of decalcified zooecia the operculum appears to be fringed proximally with long thin teeth. Specimens of *S. parviporosa*, Canu and Bassler, from Romblon and Jolo, Philippines, received from the U.S. National Museum, are more or less intermediate between the two types described above. In the shape of the orifice they agree with those from Port Phillip, but the specimen from Jolo shows some arching of the tongue, and a definite, though less conspicuous, appearance of a fringe. Canu and Bassler's pl. xxxvi, fig. 6, differs from their other figures and from all the specimens described above in the wider, shallower sinus of the orifice. It unfortunately does not show the condyles. The Barrier Reef specimen has the same shape of orifice and smooth condyles (Text-fig. 8, A, B). The specimens from Singapore, Amboyna, Clairmont Island and the Holothuria Bank agree with the Barrier Reef colony in these characters. The one from Tahiti has denticulate condyles and a sinus of variable shape, more or less intermediate, between the Barrier Reef and Port Phillip specimens. It has not been possible to detect any differences other than those in the orifice, and the specimens have all been included in *S. schizostoma*. The ovicells have a pair of teeth in the orifice as figured in *S. informata* (*S. spongites*, Smitt) by Levinsen (1909, pl. xviii, fig. 4*b*), and have an ovicellular operculum like that of *S. informata* described below (p. 425). It is not possible to tell from the figures how nearly *S. spongites* var., Hincks (1887, p. 124, pl. xii, figs. 7, 8), is related to *S. schizostoma*.

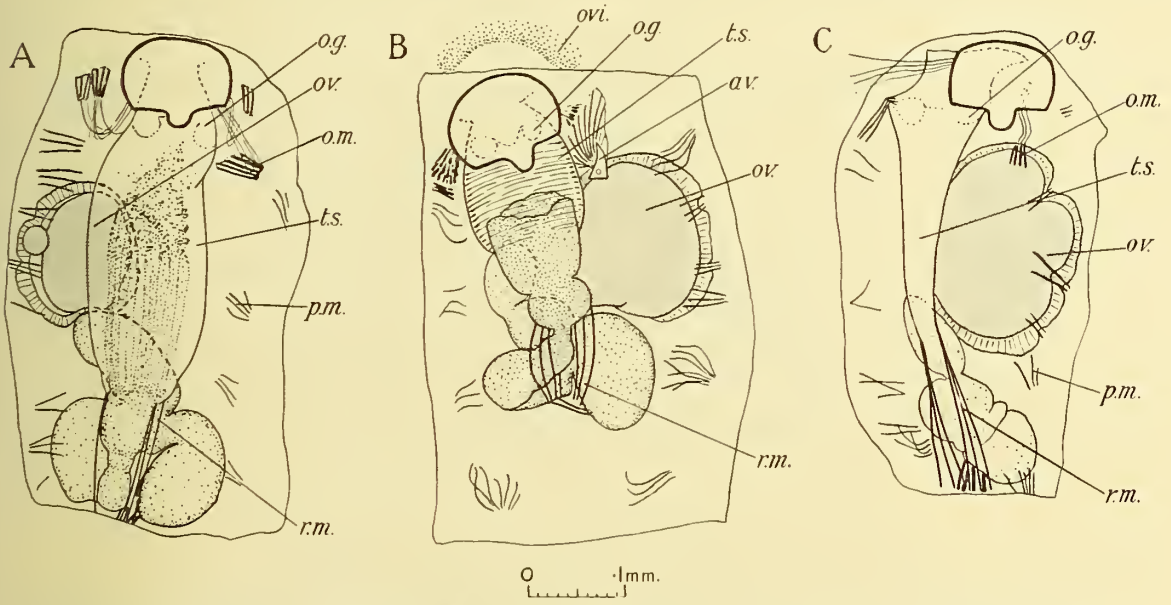
The colony from the Holothuria Bank encrusts the frontal surface of a small Cupularian colony, and on reaching the edge has continued to grow freely in the same direction, producing an irregular flatly conical colony the greater part of which is unattached. A similar colonial form has been observed in specimens of three other Schizoporellid species, two from Tsos Sima, Japan (B.M. 62.7.16.69), and one from the Holothuria Bank (B.M. 92.1.28.76). The latter, which is represented by seven specimens, has a hollow, somewhat hooked calcareous process from the basal wall of each zoœcium. It resembles *S. furcata*, Busk (1884, p. 163),* in most characters, but differs slightly in the shape of the operculum. It is remarkable for possessing vicarious avicularia with a large mandible, strong muscles and complete polypide; similar avicularia have been described in *Cribrilina philomela* by Harmer (1902, p. 293) and in the Anascan genus *Acanthodesia* (Harmer, 1926, pp. 213 *et seq.*; Hastings, 1930*a*, p. 707).† The avicularia of *Crepis decussata*, Harmer (1926, p. 320) also have a polypide.

* Examination of the type-material shows that *S. furcata* and *S. tenuis* (Busk, 1884, pp. 163, 165) are synonyms, having been described from the erect and encrusting parts of the same colony. I have retained the name *S. furcata*. The supposed specimen of *S. tenuis* from Simon's Bay appears to be a specimen of *S. nivea*, as pointed out by Waters (1888, p. 29). It is specifically distinct from the material of *S. tenuis* from Honolulu.

† Superficially similar avicularia have been figured in various species, but their internal structure is unknown, *e. g. Schizoporella cecilii* var., Kirkpatrick (1890*b*, p. 21, pl. v, fig. 8); *Parmularia quadlingi*, Livingstone (1926*a*, p. 86, pl. vi, figs. 1 and 2); *Schizomavella ovoidea*, Canu and Bassler (1929, p. 305, pl. xxxiii, fig. 7).

The ovary can be distinguished in zooecia very near the edge of an actively growing colony of *S. schizostoma* killed on 24th February, 1929. In a longitudinal series the walls of one to three marginal zooecia are being formed, the next zooecium contains a polypide bud, the next a fully formed polypide and in the next a small ovary, consisting of one or more small eggs in a follicle, may be present beside the polypide. The "female polypide" of this zooecium has clearly not been preceded by another polypide as described in the W. Indian species by Canu and Bassler (1923, p. 102; 1928*b*, p. 92). Only one of the ova increases in size, but the others remain visible and may form part of the follicle as described by Calvet (1900, p. 294, pl. ix, fig. 2, various Cheilostomes).

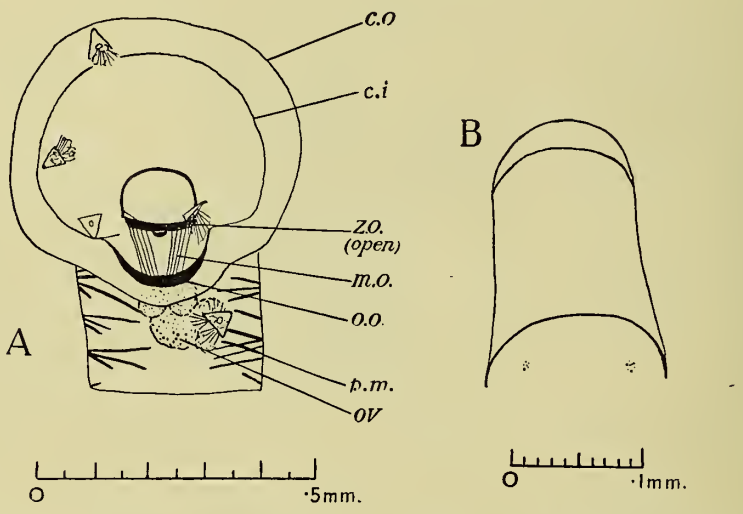
These large ovular cells in the follicle project, on the surface, and are rather conspicuous. The ordinary follicle-cells become columnar, considerably increasing the thickness of the follicle. As in Text-fig. 9, A–C, there may be thin places where the follicle



Text-fig. 9.—*Stylopoma schizostoma* (Macg.). Three stages in the degeneration of the polypide of a fertile zooecium. In C the operculum has been displaced in mounting. *av.*, Avicularium. *o.g.*, Oral gland. *o.m.*, Occlusor muscle. *ov.*, Ovary. *ovi.*, Incipient ovicell. *p.m.*, Parietal muscle. *r.m.*, Retractor muscle. *t.s.*, tentacle sheath.

is pressed against the parietal muscles. When the egg has attained a considerable size the polypide degenerates, the degeneration beginning at the tips of the tentacles (Text-fig. 9, A). Before degeneration the tentacles usually reach the diaphragm. Text-fig. 9, B, shows a stage where the tentacles are reduced to stumps and the tentacle sheath is shortened and thickened. This short-tentacled degenerating polypide is readily distinguished from a polypide-bud with tentacles of the same length by the irregular and confused appearance of the tentacles, which in the bud are clearly defined and deeply staining, by the completeness of the tentacle-sheath, which in the bud is only beginning to be differentiated, and by the relatively large size of the viscera. At this stage the first indication of the ovicell can be detected. It is a curved band of closely placed cells on the frontal wall of the distal zooecium (Text-fig. 9, B). In Text-fig. 9, C, the tentacles have gone and the viscera are dwindling. The arc of ovicell-forming cells is omitted

from this figure. It has become more arched—that is, its median part has advanced distally. There is an indication of the outer capsule outside this cellular band, and both capsules are beginning to grow down beside the orifice. The frontal wall of the ovicell is incomplete. This is the most advanced stage obtained in *S. schizostoma*. It would be interesting to see later stages. The large amount of space occupied by the egg makes the formation of another polypide before the completion of the ovicell very improbable. In the American species Canu and Bassler write of a female polypide without tentacles " which constructs the ovicell." They do not explain in what way such a polypide is supposed to assist in the construction of the ovicell. In *S. schizostoma* the polypide without tentacles is clearly degenerating, and the occurrence of this degeneration when the ovicell is beginning to be formed shows, I think, that in that species the polypide takes no active part in building the ovicell. Doubtless the degeneration of the polypide liberates materials for use in other ways, but there is the increase in size of the egg as well as the construction



TEXT-FIG. 10.—*Stylopoma informata* (Lonsd.) from Galapagos. A, Fertile zooecium and empty ovicell decalcified. B, Ovicellular operculum and tip of zooecial operculum; muscles omitted. *c.i.*, Inner capsule. *c.o.*, Outer capsule. *m.o.*, Muscles of ovicellular operculum. *o.o.*, Ovicellular operculum. *ov.*, Ovary. *p.m.*, Parietal muscle. *z.o.*, Zooecial operculum.

of the ovicell to account for. Little or no trace of oral glands has been detected in the non-fertile zooecia. In the early stages of the fertile zooecia a small protuberance on each side of the diaphragm can usually be detected, and in later stages, such as are figured here, a pair of spherical glands is clearly present.

A few zooecia contain clusters of sperm-forming cells, but spermatozoa are not being developed in any quantity. In a colony of *S. informata* (*S. spongites*, Hastings, 1930*a*, p. 721) collected at the Galapagos Islands on 7th August, 1924, the marginal zooecia contain large quantities of mature sperm, and a small ovary may be present as well. Within this marginal zone many of the zooecia bear fully-formed ovicells, but earlier stages of the fertile zooecia have not been found. The ovicell-bearing zooecia, which all have enlarged parietal muscles and no polypide, are in three states: (1) The ovicell is empty, and a large egg, enclosed in a follicle and accompanied by some small ones, occupies the cavity of the zooecium. (2) There is a large egg or embryo in the ovicell, and in the body-cavity

an ovary consisting of a cluster of eggs, most of which are rather larger than the accessory eggs in state 1. (3) The ovicell is empty and the ovary may be in state 2, or one of the eggs may be enlarged and surrounded by a definite follicle. After decalcification the fully formed ovicell of the Galapagos specimen is seen to consist of a pair of concentric, spherical, membranous capsules (Text-fig. 10, A). The zooecial orifice opens into the ovicell, and to the distal end of its operculum is attached an ovicellular operculum (Text-fig. 10, A, B). This ovicellular operculum is less strongly chitinized than the zooecial operculum; it appears to be continuous laterally with the inner membranous sac, and it is deeply hollowed. A pair of broad muscle-bands run from its distal border and appear to be attached within the zooecial orifice, but the exact point of attachment cannot be made out. Numerous fine muscles radiate from the distal border of the zooecial orifice to the walls of the inner membranous sac. They are so numerous and so fine that they have been omitted from the figure. It will be noticed that the avicularium buried beneath the ovicell has lost its musculature. Those with muscles are on the surface of the ovicell.

A specimen from the Providence Reef, Mascarene Islands (B.M. 82.10.18.48) appears to be the form obtained from the Gulf of Manaar by Waters (1918*a*, p. 17). The orifice (Text-fig. 8, L) has a knob-like tooth on each side of the sinus, and the sockets in the operculum to which these teeth articulate are conspicuous. The operculum (Text-fig. 8, K) resembles that of the genotype in having a disc-like tip to the tongue, but both tongue and tip are narrower and the operculum is uniformly curved in outline, not wider proximally. The orifice of the ovicell is traversed by a calcareous bar, occupying the position of the teeth in most other species. The ovicell thus has two orifices and resembles that of *S. viride*, in which, however, the bar is broader, and the ovicell being flatter the orifices are directed proximally instead of obliquely towards the frontal wall of the fertile zooecium. As suggested by Canu and Bassler (1928*b*, p. 92) this appears to be a distinct species.

Stylopoma viride (Thornely). (Text-fig. 8, M.)

Schizoporella viridis, Thornely, 1905, p. 116, pl. i, fig. 3; 1912, p. 148; Waters, 1909, p. 147, pl. xiii, figs. 1–8; 1918*a*, pl. ii, fig. 18; Marcus, 1921*b*, p. 17; Livingstone, 1926*a*, pl. viii, fig. 10.
Stylopoma grandis, Canu and Bassler, 1929, p. 316, pl. xxxvii, figs. 1–3.

Occurrence.—Batt Reef; Low Is. (shore).

Distribution.—New Guinea, Aru Islands, Philippine Islands, Indian Ocean, Red Sea.

There can be no doubt that these specimens belong to Thornely's species, with which they agree very exactly. The pieces of Thornely's specimen in the British Museum (06.12.3.10) and the Manchester Museum (Waters Collection) are both without ovicells, but one is shown by Thornely (1905, pl. i, fig. 3) and agrees with those of the Barrier Reef specimen. The separation of the transverse oval orifice of the ovicell from the zooecial orifice, as shown in this figure, is mentioned by Waters and Marcus. This is all that can be seen in direct frontal view, but, by tilting the Barrier Reef specimens, a slit can be seen between the proximal edge of the ovicell and the frontal wall of the zooecium. The sinus of the zooecial orifice can be seen through this aperture. The zooecial operculum bears an ovicellular operculum as in the other species of *Stylopoma* described above. On many of the ovicells of the Barrier Reef specimens of *S. viride* there is a small pointed avicularium, directed outwards on each side of the oval distal aperture, and there may be small ones on humps on the distal circumference of the ovicell.

The elongated, adventitious avicularium on the distal side of the orifice (Thornely, 1905, pl. i, fig. 3 ; 1912, p. 148) may be present on nearly every zooecium of the single regular layer at the edge of the colony. It may be transverse as shown, or placed beside the orifice, pointing obliquely towards the distal end of the zooecium. Its mandible, like that of the vicarious avicularium, has a triangular base and a long, laterally compressed, knife-like rhachis. The small avicularium below the orifice may be present on the same zooecium as the large distal one.

The Mediterranean specimen which Waters (1909, p. 147) identified with *S. viride* is superficially very similar, but it has markedly different opercula and mandibles and is clearly a distinct species. Busk's manuscript name for it, published by Waters, remains a *nomen nudum*.

S. grande, Canu and Bassler (1929), is clearly a synonym of *S. viride* (Thornely). It agrees in the shape of the orifice, in the form of the adventitious and vicarious avicularia, in the ovicells, in the plurilamellar colony and the green colour.

Livingstone (1926*a*, p. 84) described a variety of *S. viride* with blunt vicarious avicularia which was obtained on the Barrier Reef. This variety is not represented in the present collection. While fully recognizing their distinctness, Livingstone compared some characters of this variety to *Schizoporella ampla*, Kirkpatrick (1888*a*, p. 76). It may be worth recording that I have examined the type of *S. ampla*, and confirmed the accuracy of Kirkpatrick's description and figures. The comparatively small ovicell, which does not cover the orifice, will, if *Stylopoma* is found to be a good genus, distinguish *S. ampla* and *S. viride* generically.

Hippothoa distans, Macgillivray.

Hippothoa distans, MacGillivray, 1869, p. 130 ; Waters, 1904, p. 54, pl. iii, figs. 8*a–g* (references).
Hippothoa flagellum, Canu and Bassler, 1929, p. 247, p. xxii, fig. 7.

Occurrence.—St. XII.

Distribution.—Australia, New Zealand, Malaya, Indian Ocean, European Seas, Atlantic, Antarctic, Queen Charlotte Island.

This specimen, like that of Canu and Bassler, has the ovicell-bearing cells of approximately the same size as the rest. A specimen from Port Phillip (B.M. 97.5.1.788) agrees with Waters's figure in having small ovicelligerous cells.

Mastigophora pesanseris (Smitt).

Hippothoa pes anseris, Smitt, 1873, p. 43, pl. vii, figs. 159, 160.
Mastigophora pesanseris, Osburn, 1927, p. 130 ; Canu and Bassler, 1929, p. 412, pl. lviii, figs. 4–8 (references).
Mastigophora pes-anseris, Hastings, 1930*a*, p. 722.

Occurrence.—N.E. Low Is.

Distribution.—Philippines, Hawai, Indian Ocean, Madeira, Brazil, Florida, Panama.

Trypostega venusta (Norman).

Lepralia venusta, Norman, 1864, p. 84, pl. x, figs. 2, 3.
Trypostega venusta, Livingstone, 1927, p. 58 ; Canu and Bassler, 1929, p. 248, pl. xxii, figs. 9–11 ; Hastings, 1930*a*, p. 720 (references).

Occurrence.—St. XIII.

Distribution.—Queensland ; Philippines ; China Sea ; Jicaron Island, Panama ; Indian Ocean ; Atlantic ; English Channel.

Microporella ciliata (Pallas).

Eschara ciliata, Pallas, 1766, p. 38.
Microporella ciliata, Maplestone, 1909, p. 268 ; Osburn, 1927, p. 129 ; Canu and Bassler, 1929, p. 331, pl. xl, figs. 2–4 ; Hastings, 1930*a*, p. 727 (references).

Occurrence.—St. XIII, XXI.

Distribution.—Cosmopolitan.

The specimen from St. XIII is a small colony of the typical form, and has very thin walls and somewhat elongate avicularia. That from St. XXI is of the personate type.

Microporella malusii (Aud.).

Cellepora malusii, Audouin, 1826, p. 239 ; Savigny, pl. viii, figs. 8^1, 8^2.
Microporella malusii, Waters, 1887, p. 188 ; Kirkpatrick, 1890*a*, p. 612 ; Macgillivray, 1890*c*, p. 4 ; Marcus, 1921*c*, p. 108, pl. v, fig. 8 ; 1921*d*, p. 107, text-fig. 9 ; Livingstone, 1926*a*, p. 98 ; 1927, p. 62.
Fenestrulina malusii, Canu and Bassler, 1923, p. 115, pl. xxxvi, figs. 2, 3 (literature) ; Livingstone, 1929, p. 89.

Occurrence.—St. XII.

Distribution.—Cosmopolitan.

Another Australian form allied to *M. malusii* is represented in the British Museum (97.5.1.677 and 679) by specimens from Port Phillip and in the Cambridge Museum by some from Port Jackson. The ovicells are deeply immersed in the distal zooecium, so that they hardly project frontally, although all the parts of the ovicell of typical *M. malusii* can be recognized in them.

Microporella mutabilis, sp. n. (Plate I, fig. D ; Text-fig. 11.)

Microporella malusii, Haswell, 1881, p. 38 ; Livingstone, 1926*a*, p. 98.
? *Microporella malusii*, Thornely, 1912, p. 146, pl. viii, fig. 8.

Occurrence.—St. XII.

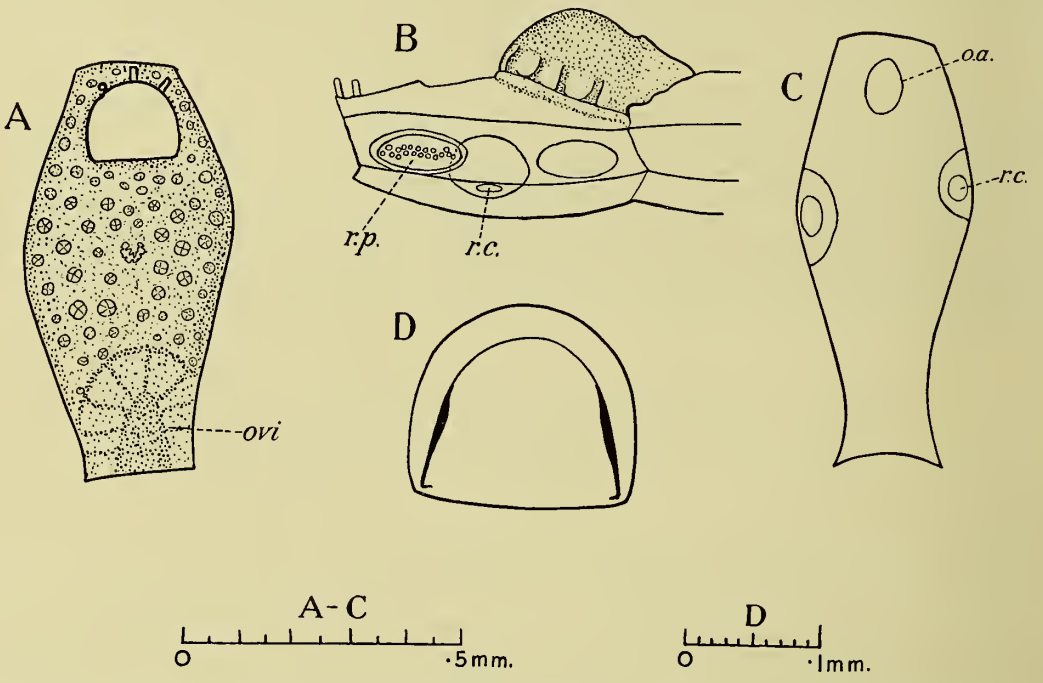
Distribution.—Great Barrier Reef, Port Denison.

Type.—St. XII (B.M. 32.4.20.50).

Description.—In *M. malusii* the colony is encrusting, the zooecia are not much longer than wide, and the frontal wall has an imperforate area behind the ascopore, the stellate, frontal pores being more or less marginal. There are three long, narrow pore-chambers, one distal and one on the distal half of each lateral wall. In the type-specimen of *M. mutabilis* the colony is hemescharan (Plate I, fig. D), and has a flustrine appearance (*cf.* Livingstone, 1926). Its basal surface is covered throughout by a thin layer of a sponge, *Oscarella tenuis*, Hentschel, but the hemescharan form is not due to this, for a hemescharan specimen from Port Denison is quite free from sponge, and Mr. Livingstone informs me that none of his specimens bear any such growth. The stellate pores are uniformly distributed over the frontal surface, and the zooecia are usually considerably longer than broad (Text-fig. 11, A). The orifice is approximately the same size as in *M. malusii*, but may be a little longer in proportion to its width. The operculum (Text-fig. 11, D) is essentially similar, but the sclerite is a little further from the margin. There may be two to four spines on the distal border of the orifice. The sponge can be readily peeled off, and the basal surface is then found to differ from that of *M. malusii*. In the majority of the zooecia no pore-chambers are visible, and it seems that they really are absent, their places being taken by three multiporous rosette-plates, each occupying the elongate, oval area of the lateral or distal wall against which the pore-chamber is found

in *M. malusii*. The basal wall (Text-fig. 11, c) has an oval, uncalcified area of variable size in its distal part, and on each side a chamber from which a rootlet may spring. The rootlet chamber resembles a pore-chamber in occupying the angle between the basal and lateral walls, and being cut off from the body-cavity by an oblique wall. This wall bears a group of pores. The chamber is placed proximally to the rosette-plate and very close to it (Text-fig. 11, B). The rootlet-chambers and oval area are not found on all the zooecia, and one, two or three pore-chambers may be present.

On the cruise of H.M.S. " Alert " escharan as well as hemescharan specimens of this species were obtained from 3–4 fath. off Port Denison (B.M. 81.10.21.23, 82.2.23.89). No exact locality is given for a loosely encrusting colony obtained on the same cruise (B.M. 81.10.21.355). These specimens agree with the Barrier Reef specimen in their



Text-fig. 11.—*Microporella mutabilis*, sp. n. A, Frontal view. B, Side view. C, Basal view. D, Operculum. *ovi.*, Incipient ovicell of proximal zooecium. *o.a.*, Oval area. *r.c.*, Rootlet-chamber. *r.p.*, Rosette-plate.

large zooecia, and large, evenly distributed pores. The distribution of pore-chambers, rootlet-chambers and oval areas is most erratic. In the hemescharan specimen the majority of the zooecia have the oval area present and pore-chambers absent, but the oval area may be absent and one or more pore-chambers may be present. Rootlet chambers were not found. The two layers of the escharan specimen are readily separable, and between them is a thin layer of material which contains some spicules and may be a sponge. Neither oval areas nor rootlet chambers were seen and pore-chambers are very irregularly distributed, many zooecia having none, others one, two or three. The loosely encrusting specimen agrees with the type in having an oval area, rootlet-chambers and no pore-chambers in the majority of its zooecia and it shows similar variability. There may be two rootlet-chambers on the same side of the zooecium, one occupying the distal corner.

Occasionally, notably in the material from Port Denison in the Cambridge Museum, there is a pair of small lateral oval areas in the basal wall, marking the attachment of the occlusor muscles of the operculum.

To sum up, this species is distinguished from *M. malusii* by the larger size of its zooecia, by the uniform distribution of the pores, by the absence of pore-chambers in some zooecia and by slight differences in the orifice and operculum. The colony may be escharan, hemescharan or loosely encrusting. The oval area and rootlet-chambers are not invariably developed, but they are very distinctive when present. *M. malusii* and *M. mutabilis* were both obtained at the same station in 10–15½ fath.

Remarks.—Part of the material from Port Denison identified by Haswell (1881, p. 38) with *M. malusii* is in the Cambridge Museum and belongs to *M. mutabilis*. *M. malusii*, Thornely (1912), from the Indian Ocean, agrees with *M. mutabilis* in its large zooecia and uniformly distributed pores, but no ribs are described or figured round the ovicell.

A loosely encrusting specimen, collected by Darwin at the E. Falkland Islands (B.M. 99.7.1.2668), seems to be nearer to *M. mutabilis* than to *M. malusii*, though distinct from both. It agrees with *M. mutabilis* in its large zooecia and pores, in the presence of an oval area in the basal wall and in the absence of pore-chambers. There are no rootlet chambers. It has a small area free from pores behind the ascopore, thus approaching *M. malusii*. The ends of the sclerite of the operculum turn slightly outwards, and show no trace of the little sclerite projecting at right angles that is found in *M. malusii* and *M. mutabilis*. The orifice is considerably larger than in *M. malusii*, and the ovicell may bear fine radiating striations. Similar specimens were obtained by the "Challenger" from the Falkland Islands, and by Jullien (1888, p. 38) and Darwin at Tierra del Fuego. The latter material is figured by Busk (1854, pl. ciii, figs. 1–3), who mentions the large size of the zooecia compared with the European form. The "central flattened disc" is evidently the oval area. It is of similar size in the Falkland Island specimen. It appears rather different from that of *M. mutabilis* owing to its large size, but there is considerable variation in this respect in the hemescharan specimen from Port Denison, some being as large as those from the Falkland Islands. The ancestrula is included in two of Darwin's specimens, and the surrounding zooecia are of the thyreophora-form. The ancestrula is membraniporine and has spines all round the opesia. Waters (1904, p. 42) records specimens of the thyreophora-form from Chili, with large zooecia and apertures, which may be the same species.

Canu and Bassler (1928*a*, p. 84) described *Fenestrulina ampla*, a large species from Brazil, which differs from Darwin's species in its small circular ascopore, thick border to the operculum and rather smaller orifice. The average of a number of measurements of the orifices of Darwin's species exceeds the maximum given by Canu and Bassler for *F. ampla*.

Smittina signata (Waters). (Text-fig. 12 D, E.)

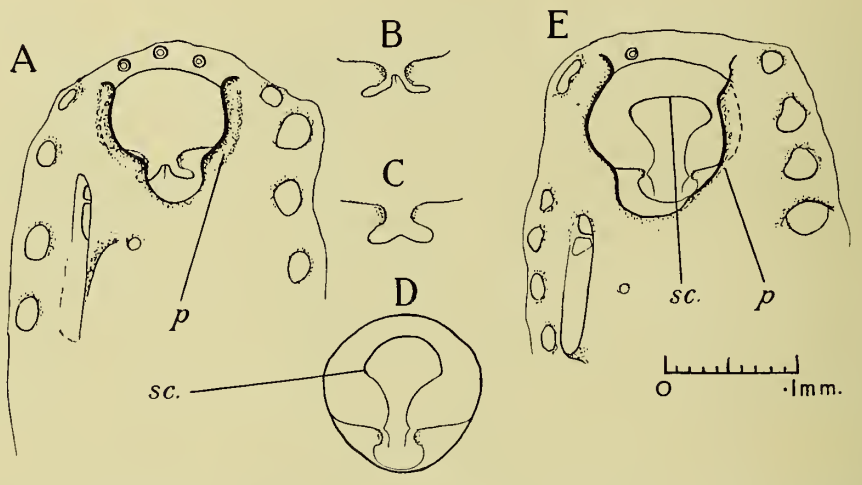
Smittia signata, Waters, 1889, p. 17, pl. iii, figs. 4–6; Thornely, 1912, p. 151.
Lacerna signata, Canu and Bassler, 1929, p. 308, pl. xlii, figs. 10, 11, text-fig. 131C (not D).

Occurrence.—N.E. Low Is.; St. XXII.

Distribution.—New South Wales, Indian Ocean, Philippines, Tahiti (Crossland Coll., B.M. 29.4.25.2 and 3).

These small encrusting colonies agree very closely with Waters's type-specimen. The sclerites of the operculum (Text-fig. 12, D, E) are more bowed, but, as the figures show, there is some variation in their shape. The peristome may be less developed, or may be continued round the distal border of the orifice. The ligulate avicularia vary in size, and may be only half the length of that figured. The large, spatulate avicularia are more numerous towards the centre of the colony. The spines are rarely visible, their stumps apparently becoming buried in a calcareous crust.

The specimens of Canu and Bassler (1929) from the Philippines appear to differ in the triangular shape of the sclerite of the operculum, but under a low magnification the more constricted sclerites of the Barrier Reef material may give this impression. The Barrier Reef specimens agree in size with those from the Philippines, the orifices being slightly larger than in the type. In some fragments from Okinose, off Tokyo, in the Cambridge



TEXT-FIG. 12.—A–C, *Smittina*, sp., from the Tizard Bank. D, E, *Smittana signata* (Waters). A, Distal part of a zooecium. B, C, Lyrula and condyles. D, Orifice and operculum. E, Distal part of a zooecium. *p.*, Peristome. *sc.*, Sclerite.

Museum, the zooecia and orifices are even larger (diameter of orifice ·13–·15 mm.). In this Japanese material the denticulation extends along the distal border of the condyle, as in *Smittina* sp. (Text-fig. 12, A–C) from the Tizard Bank, described below.

Canu and Bassler put *S. signata* in *Lacerna*, Jullien (1888, p. 48), but according to Waters (1904, p. 51) the genotype, *L. hosteensis*, has a schizoporellid operculum. *S. signata* differs from the typical species of *Smittina* chiefly in the absence of a median tooth or lyrula, and at present I see no need to separate it, more especially as a very similar species from the Tizard Bank (B.M. 89.8.21.17b) has a pointed tooth of variable size in the position of the lyrula (Text-fig. 12, A–C). The specimen is unfortunately very small and without opercula. The peristome, the denticulate condyles and the spatulate and ligulate avicularia are very much like those of *S. signata*, but the denticulation extends along the distal border of the condyle as in the Japanese specimen described above.

Schizopodrella horsti, Osburn (1927, p. 127), appears to be another *Smittina*-like species with no lyrula. The operculum is described as slightly chitinized and is presumably without the sclerites of *S. signata*.

The species from the Red Sea, identified by Waters (1909, p. 157, pl. xiii, fig. 9) with *S. marmorea*, appears to be more nearly related to *S. signata*, but its operculum is unknown.

Smittina obstructa (Waters).

Smittia obstructa, Waters, 1889, p. 18, pl. iii, figs. 7, 8.

Occurrence.—Batt Reef.

Distribution.—New South Wales.

This specimen agrees closely with Waters's, but has no ovicells. The operculum is of characteristic form, but slightly less chitinized. The peristome is prominent laterally, though not quite so markedly so as in Waters's specimen, and frequently has an avicularium "leaning against the prominence." There are small blunt avicularia on the frontal wall of some zooecia and some very large spatulate ones. In this specimen, unlike that described by Waters, the large spatulate avicularia are not vicarious, but are on the frontal wall, with their proximal end beside the orifice of the zooecium. The only one visible on the specimen from the Waters Collection lent to me is, however, similar, though the orifice of the zooecium can only be discerned clearly when the specimen is wet. In form and position the spatulate avicularia resemble those of *S. trispinosa* var. *inaequalis* (Waters, 1879, p. 41), and superficially the specimen might be taken for that form, especially as a Neapolitan specimen of the latter presented by Mr. Waters (B.M. 79.4.25.25) has a pointed avicularium beside the peristome of some zooecia. The two forms are clearly distinguished by their opercula.

Smittina acaroensis, Levinsen.

Smittina acaroensis, Levinsen, 1909, p. 342, pl. xviii, figs. 12*a*, *b* (*S. akaroensis* in description of plate).

Occurrence.—St. IX, XII.

Distribution.—New Zealand, Bass Strait (B.M. 99.5.1.1127).

These two young colonies do not show the extreme development of the ribs between the areolae described by Levinsen. The spines vary from 4 to 6, and the areolae do not form such a definite border to the ovicell. Otherwise the agreement with Levinsen's description is very close. The material is insufficient for examination of the rosette-plates. The mandible is semicircular, with two oblique sclerites. Older colonies from New Zealand in the British Museum show advanced calcification as described by Levinsen. In the specimen from Bass Strait the avicularia vary in size.

S. acaroensis is very closely allied to the areolated type of *S. landsborovii* shown by Hincks (1880, pl. xlviii, fig. 7). The specimens of *S. acaroensis* in the Hincks and Wilson Collections in the British Museum are labelled "*S. landsborovii* ?" and it seems possible that some of the published records of *S. landsborovii* in the Australian and Indo-Pacific regions may be based on this species.

Phylactella geometrica, Kirkpatrick.

Phylactella geometrica, Kirkpatrick, 1890*b*, p. 20, pl. v, figs. 7–7*c*.

Occurrence.—St. II.

Distribution.—China Sea.

Cigclisula. (Text-fig. 13.)

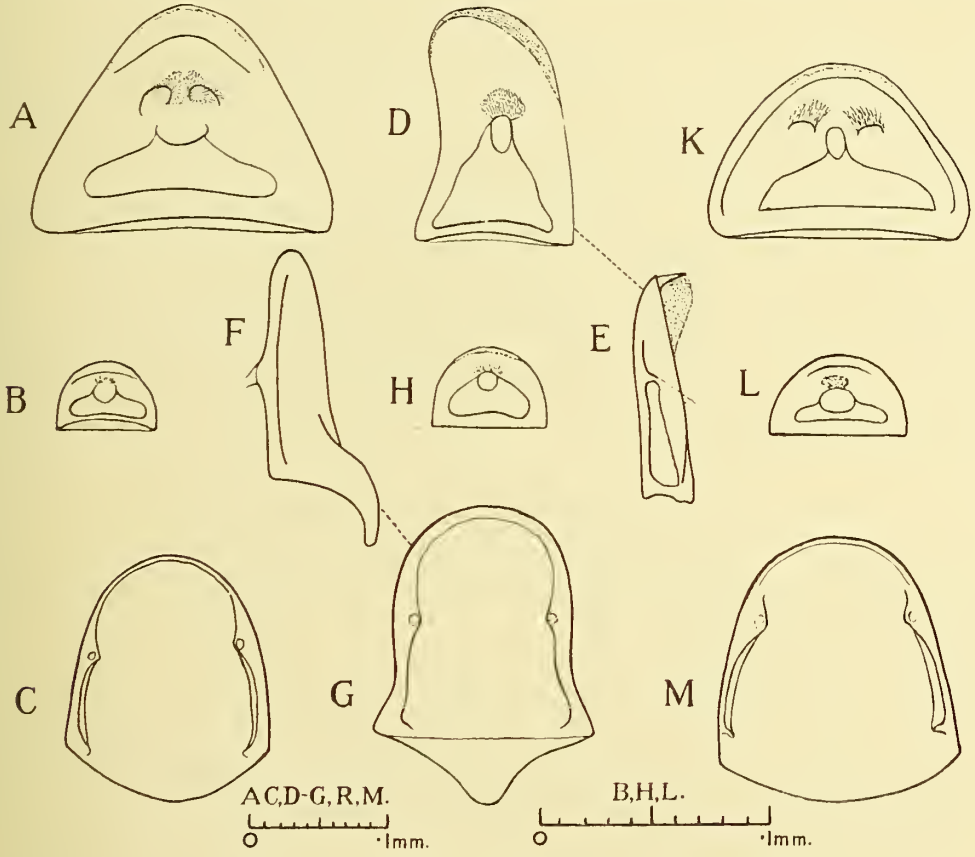
Escharoides occlusa, Busk (1884, p. 150) has been referred to the following other genera: *Lepralia* (by Waters, 1888, p. 26), *Myriozoum* (by Levinsen, 1909, p. 301, and Marcus, 1921*a*, p. 20; 1922, p. 435), *Cigclisula* (by Canu and Bassler, 1927*a*, p. 6). Livingstone (1926*a*, p. 91) puts the closely allied form *C. areolata* (Kirkpatrick, 1890*a*, p. 618) in *Porella*. Although retained provisionally by Marcus, I think the attribution to *Myriozoum* can be dismissed at once for the reasons given by Waters (1913, p. 519). *Escharoides*, Milne-Edwards (1836, p. 259), is almost unanimously abandoned owing to difficulties about the genotype which need not be recounted here. Strictly according to the rules *Lepralia* is a synonym of *Escharoides*, but Norman (1903, p. 99) and Lang (1917, p. 171) retain it with *Lepralia nitida* (Fleming) as genotype. In either case the name is not available for *E. occlusa*, which differs in its orifice from *L. nitida*, and from all the other species included in *Lepralia* by Johnston. *Porella* was introduced by Gray (1848, p. 127) for *Millepora cervicornis*, Solander (1786, p. 134), *M. compressa*, Sowerby (1805, p. 83), being given as a synonym. These two species are distinct, and Norman (1903, p. 112) selected *M. compressa* as the genotype of *Porella*. This selection has priority over that of *M. cervicornis* by Canu and Bassler (1917, p. 54). *Cigclisula* was introduced by Canu and Bassler (1927*a*, p. 6) with *E. occlusa* as genotype.

The choice of genus for *E. occlusa* thus lies between *Porella* and *Cigclisula*, but before their claims can be considered the characters of *E. occlusa* must be defined a little more closely.

Marcus (1921*a*, pl. i, fig. 8) figured an operculum shaped to fit an orifice with a definite sinus. He assumed some inaccuracy in Waters's figure (1888, pl. iii, fig. 32) of an operculum from the type-specimen from Samboangan. Waters's is an accurate picture of some opercula. Others on the same slide are longer, like those of Canu and Bassler (1929, p. 292, text-fig. 122, C, D), but none approach the type of operculum figured by Marcus. Such an operculum is, however, found in three specimens in the British Museum (B.M. 92.1.28. 71A and 72, 86.2.19.9), all from W. or N.W. Australia, which is the region from which Marcus obtained his first material (Text-figs. 13, F, G). His specimens from the Aru Is. (1922, p. 435) were apparently of the same type. The two forms agree closely except for the remarkable difference in the orifice, and more or less intermediate specimens are found (B.M. 92.4.14.4, 51.11.14.75).

The type of *E. occlusa* resembles *P. compressa* and the species associated with it in many ways. They agree in the more or less semicircular primary orifice, with rounded corners, the thickening of the frontal wall and the formation of a peristome with an avicularium in its proximal wall. The formation of the ovicell seems to be similar, though the incomplete frontal calcification of that of *E. occlusa* gives it a superficially different appearance. There are some differences, however, that may be more important. Oblique sclerites are not a conspicuous feature of the mandibles of *E. occlusa*, and the oral glands form a large and rather complex median structure (Waters, 1909, p. 152). *P. compressa* has paired glands of ordinary size and shape. In *P. compressa* the formation of the peristome and avicularium is accompanied by a thickening and straightening of the proximal lip of the primary orifice, almost amounting to the formation of a broad shallow lyrula, though a lyrula is usually stated to be absent in *Porella*. In *E. occlusa* the proximal edge is more concave and remains so. In *P. compressa* and most if not all

undoubted species of *Porella* the peristomial avicularium is median and directed frontally; in *E. occlusa* it is lateral and directed obliquely. If *E. occlusa* were the only species of its kind the differences enumerated above would hardly justify its separation from *Porella*, but the existence of several species allied to *E. occlusa*, and differing from true *Porella* in most if not all these ways (the oral glands of some are not known), supports the view that *E. occlusa* deserves generic rank. Besides the two species recorded in this paper, *Porella fissurata*, Ortmann (see Livingstone, 1926*a*, p. 92), and *Cellepora verticalis*, Maplestone (1910, p. 39), appear to be congeneric with *E. occlusa*. A topotype of *C.*



Text-fig. 13.—A–C, *Cigclisula cautium*, sp. n. D–H, *C. occlusa* from the Holothuria Bank, "Marcus's form." K–M, *C. verticalis* (Maplest.). A, Mandible of large oral avicularium of marginal zooecium. B, Mandible of small oral avicularium. C, Operculum. D, E, Mandible of large oral avicularium, slightly oblique and lateral views. F, G, Operculum, frontal and lateral views. H, Mandible of small oral avicularium. K, L, Mandible of large and small oral avicularia. M, Operculum.

verticalis (B.M. 10.9.19.1) agrees with *E. occlusa* in the general form of the primary orifice and operculum (Text-fig. 13, M), in the very extensive secondary calcification, in the position of the avicularium in the peristome, in the structure of the avicularian mandibles (Text-fig. 13, K, L), and in the ovicell with a frontal fissure. It differs in the wider, less shaft-like peristome, in which the avicularium remains clearly visible, in the form of the colony and in the absence of vicarious avicularia. I have accepted *Cigclisula* for this group of species, and would distinguish it from *Porella* by the fissured ovicell, lateral and oblique peristomial avicularium, and possibly the large median gland. The definition

of Canu and Bassler must be modified to admit forms with a simply fissured ovicell and a frontal wall with either pores or areolae. *Porina serrulata*, Smitt (1873, p. 27), was included in this genus by Canu and Bassler (1928*b*, p. 125), but is omitted here because of its median pore. It also differs in the position of the peristomial avicularium.

In *C. verticalis* the basal parts of the escharan colony become thickened by the development of superficial layers of zooecia. It is interesting to compare the method in *C. occlusa*, where superficial layers are not formed to any marked extent, but the old zooecia at the base of the colony are converted into kenozooecia. This takes place by great thickening of their calcareous walls and closure of the orifice as described by Busk (1884, p. 150). In some specimens, *e. g.* that from Albany Passage, Torres Straits (B.M. 90.3.24.51), this formation of kenozooecia may take place in stages. First there is a great deposition of calcareous matter and the orifice becomes smaller. Then an avicularium is formed over the orifice with its mandible directed backwards. The mandible resembles those of the vicarious avicularia in shape, but is smaller. It is also distinguished by its direction, those formed at the growing edge in the ordinary way pointing forward (Canu and Bassler, 1929, p. 291). As calcification proceeds a film of calcareous matter spreads over the avicularium and it finally becomes buried. Thus the ultimate appearance of the kenozooecia is the same whether an intermediate avicularian stage occurs or not. This forms an interesting parallel to the processes of secondary thickening in the Reteporidae described by Buchner (1924, p. 173, etc.), in which the avicularia play an important part.

Cigclisula areolata (Kirkpatrick).

Lepralia occlusa, var. *areolata*, Kirkpatrick, 1890, p. 618, pl. xvi, figs. 7, 7*a*.
Porella areolata (encrusting specimens), Livingstone, 1926*a*, p. 91, pl. viii, fig. 4 ; 1927, p. 64.
Not *Porella areolata*, Ortmann, 1889, p. 42.

Occurrence.—Batt Reef.

Distribution.—Torres Straits, Barrier Reef.

There is a circular encrusting colony of this form, with a second layer of zooecia forming at the centre. The type-specimens are encrusting and several layers thick. Livingstone records both encrusting and erect forms from the Barrier Reef, but there is evidence, as explained below under *C. cautium*, that his erect specimens belonged to that species. Spatulate avicularia are present as they are in the type, though not mentioned by Kirkpatrick, and in Livingstone's specimens. Spirit material for the examination of the oral glands has not been available.

The primary orifice of *C. areolata* is broader in proportion to its height and rounder than that of *C. occlusa*. At first the frontal wall is uniformly punctured as in *C. occlusa*, but with increased calcification it develops marginal areolae and an imperforate central area. In the specimens examined by me the beak of the vicarious avicularium of *C. areolata* has straight sides converging towards the hinge, and that of *C. occlusa* has curved sides with the narrowest part a little distal to the hinge. The mandible has this curved outline in both species.

Ortmann (1889, p. 42) introduced the name *Porella areolata* independently for a species unconnected with the present group. This would have priority if the genus *Cigclisula* were to be merged in *Porella*, but at present there is no need to suppress Kirkpatrick's name.

Livingstone (1926*b*, p. 247) recorded, as *Porella*, sp., a colony from the Capricorn Group, and described it as "closely allied to *Porella areolata*" and with characters "somewhat in accordance with *Mucronella mentalis*, Macgillivray" (1890*a*, p. 109). Its position remains uncertain.

Cigclisula cautium, sp. n. (Text-fig. 13, A–C.)

Porella areolata (erect specimens), Livingstone, 1926*a*, p. 91, pl. viii, figs. 2, 3.

Occurrence.—St. XIV.

Distribution.—Barrier Reef; Tsos Sima, Japan (B.M. 62.7.16.76).

Holotype.—St. XIV (B.M. 32.4.20.54).

Description.—The colonies consist of flattened branches that are narrower than those of most specimens of *C. occlusa*. The zooecia are longer than those of *C. occlusa*. The frontal wall from its first formation has marginal areolations and has its central part imperforate or with two or three pores, as in Livingstone's pl. viii, fig. 2. With increased calcification irregular lumps and processes are formed. As in *C. occlusa*, the orifice is variable in length, but it is usually longer and its proximal border is straighter than that of *C. occlusa* (Text-fig. 13, C). The mandibles of the peristomial avicularia (Text-fig. 13, B) are of the same type as those of *C. occlusa* and *C. areolata*, but those on the marginal zooecia are often large and triangular (Text-fig. 13, A) and placed in a plane perpendicular to the frontal surface, in such a way as to be conspicuous even in heavily calcified zooecia. The vicarious avicularia are long and rather slender, and small round avicularia occur sporadically on the frontal surface. The ovicells resemble those of *C. occlusa*, and the oral glands are of the peculiar type described in that species by Waters (1909, p. 152).

Remarks.—This species is distinguished from *C. areolata* by the absence of a uniformly perforate stage in the formation of the frontal wall, by the greater average length of the opercula, by the large, triangular, peristomial avicularia on some marginal zooecia, by the long slender vicarious avicularia with curved sides to the beak, and possibly by the erect branching form of the colony. It is distinguished from *C. occlusa* by the areolated frontal wall, the straighter proximal edge of the orifice and the large triangular avicularia. The oral avicularia of *C. occlusa* may be much enlarged, but these large avicularia do not occur specially on the marginal zooecia, they overhang the orifice and the mandible is spatulate (Text-figs. 13, D, E).

Livingstone does not state whether his figures were made from erect or encrusting specimens, but as figs. 2 and 3 agree with the present form, it may be surmised that they were made from erect ones. Fig. 4, on the other hand, agrees with the encrusting form, to which the name *C. areolata* is here restricted. It does not follow that all Livingstone's erect specimens belonged to *C. cautium*, but it seems probable.

Petraliidae.

A start has been made with sorting the Petraliidae into genera by the introduction of *Petraliella* and *Coleopora* by Canu and Bassler (1927*a*, pp. 5, 6). According to the usage of Canu and Bassler (1929, p. 255), all the Barrier Reef species would be placed in *Petraliella*, but as I am not satisfied that any of them is specially related to *P. bisinuata* (Smitt,

1873, p. 59), the genotype, I prefer to put them in *Petralia*, Macgillivray (1868, p. 141*), used in the old, wide sense.

Petralia chuakensis, Waters.

Petralia chuakensis, Waters, 1913, p. 518, pl. lxx, figs. 10–14 ; Livingstone, 1926*a*, p. 99.
Petrialella chuakensis, Canu and Bassler, 1929, pp. 251, 256, text-figs. 103F, 106B.

Occurrence.—Low Isles (shore).

Distribution.—Zanzibar, Torres Straits.

These specimens agree very closely with Waters's description and specimens. The only difference detected is that, instead of one large perforated area on the dorsal surface, there are a number of smaller ones, the largest usually being median and distal.

Mr. Livingstone points out that these specimens come from a muddy habitat similar to that of the ones recorded by him from Torres Straits.

Petralia vultur var. *serrata*, Livingstone. (Text-fig. 14.)

Petralia vultur var. *serrata*, Livingstone, 1926*a*, p. 95, pl. vi, figs. 7–10 ; 1927, p. 66.
Mucronella magnifica, Kirkpatrick, 1890*a*, p. 612.
Mucronella vultur, Thornely, 1905, p. 124.
? *Petralia aviculifera*, Marcus, 1922, p. 441, pl. xxv, figs. 12*a–f*.

Occurrence.—W. Low Is., 6 fath. ; St. XII.

Distribution.—Ceylon ; Barrier Reef ; Murray Island, Torres Straits ; Fitzroy Island, Queensland (B.M. 81.10.21.72) ; Holothuria Bank, N.W. Australia, 24–34 fath. (B.M. 92.1.28.68).

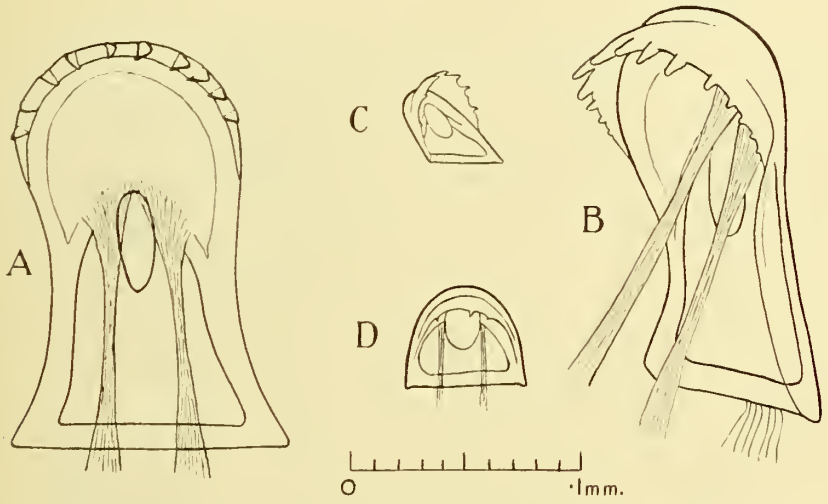
P. vultur var. *armata*, Waters (1913, p. 518) is described as having a pointed avicularium on the mucro, thus differing from Livingstone's varieties *serrata* and *bennetti*. Examining Waters's specimens I find, however, that the oral avicularia of var. *armata* are blunt with a toothed terminal flange, agreeing with his figure rather than his description. Seen obliquely under a low magnification, the flange gives the mandible the appearance of having a pointed, down-turned tip. A specimen of var. *serrata* from Peak Point (B.M. 31.10.12.6) sent by the Australian Museum has a few small round avicularia on the frontal wall, though not as many as in var. *armata*, and in the Barrier Reef specimens, which have all the types of avicularia, described in var. *serrata* by Livingstone, the small frontal avicularia are as numerous as in var. *armata*. Var. *serrata* is thus only distinguished by the presence of the long frontal avicularium. The Barrier Reef specimens differ slightly from both varieties in the orifice, which is wider than high, and has a wide median denticle.

Possibly these varieties should be regarded as specifically distinct from *P. vultur* (Hincks, 1882, p. 167, pl. viii, fig. 2), in which the avicularium on the mucro is fully visible in frontal view instead of being lateral, and the mandible ends in a down-turned point instead of being blunt with a toothed flange. A specimen from Port Phillip (B.M. 88.11.14.349) shows both these characteristics clearly.

* Canu and Bassler (1929, p. 253) give the date of the introduction of *Petralia* as 1887. This is the date of the ' Catalogue of Marine Polyzoa,' in which MacGillivray (1887*b*, p. 212) gives a slightly enlarged definition of the genus. It is not only antedated by the original introduction (1868, p. 141), but also by the slightly modified repetition of this definition in McCoy's Prodromus (MacGillivray, 1881, p. 45). In all three works it comprises the single species *P. undata*. The selection of *P. japonica* as genotype by Canu and Bassler (1929, p. 253) is therefore invalid. Waters (1925, p. 541) recognized *P. undata* as the type.

The mandible of the small frontal avicularia resembles that of the oral ones in structure, having a pair of oblique sclerites passing from the lateral edges to the distal end of the lucida and having a toothed flange (Text-fig. 14, C, D). As in Livingstone's figure, the mandibles of the large spatulate frontal avicularia are untoothed, and have a median longitudinal sclerite meeting the two oblique sclerites. The edge of the concave part of the side is very finely beaded, *cf. P. chuakensis*, Waters (1913, pl. lxx, fig. 13). The oral mandibles (Text-fig. 14, A, B) have one of the lateral edges turned in and bordered by a sclerite. The opposite edge was never seen to be bent, and it appears that the mandibles are asymmetrical in this respect. The musculature is strong and the vesicle between the occlusor muscles large as in *P. litoralis*.

The specimen from Torres Straits (B.M. 90.3.24.38) recorded by Kirkpatrick (1890*a*, p. 612) as *Mucronella magnifica* proves to be a colony of *P. vultur* var. *serrata*, and examination of part of Thornely's specimen from the Gulf of Manaar in the Cambridge Museum



TEXT-FIG. 14.—*Petralia vultur* var. *serrata*, Livingst. Oral (A, B) and frontal (C, D) avicularia, oblique and basal views.

confirms Livingstone's surmise that it could be identified with his variety. *Petraliella albirostris*, Canu and Bassler (1927*b*, p. 22), appears to be related, and resembles vars. *serrata* and *armata* in having numerous small frontal avicularia.

Marcus (1922, p. 441, *P. aviculifera*) had a form which appears to be very closely related to var. *serrata*. It resembles Livingstone's rather than my specimens in the orifice, which is longer than wide, with a narrow denticle. It has larger teeth on the small mandibles. Marcus identified it with *Mucronella aviculifera*, Hincks (1891, p. 297), but part of Hincks's specimen is in the British Museum (99.5.1.853), and is clearly distinct. The three slender columns by the orifice, one median proximal and two lateral distal, are exactly as figured by Hincks, and sometimes, at least, bear the minute avicularia shown by him. There is no trace of the distal spines, nor of the stout umbo with a lateral avicularium shown by Marcus. The median denticle of Hincks's specimen is very narrow, but the large frontal avicularia are blunt, not pointed as in Hincks's figure. They are raised, and may overhang the orifice. The zooecia are smaller and the orifice smaller and rounder than in Marcus's species.

Kirkpatrick's specimens of *P. thenardii* only differ from *P. aviculifera* (Hincks) in the branched proximal column. They have similar large frontal avicularia overhanging the orifice. They may, as suggested by Thornely (1905, p. 124), be the same species, as may also be *P. laccadivensis* (Robertson, 1921, p. 57).

Petralia litoralis, Livingstone, sp. n. (Plate I, fig. A ; Text-fig. 15.)

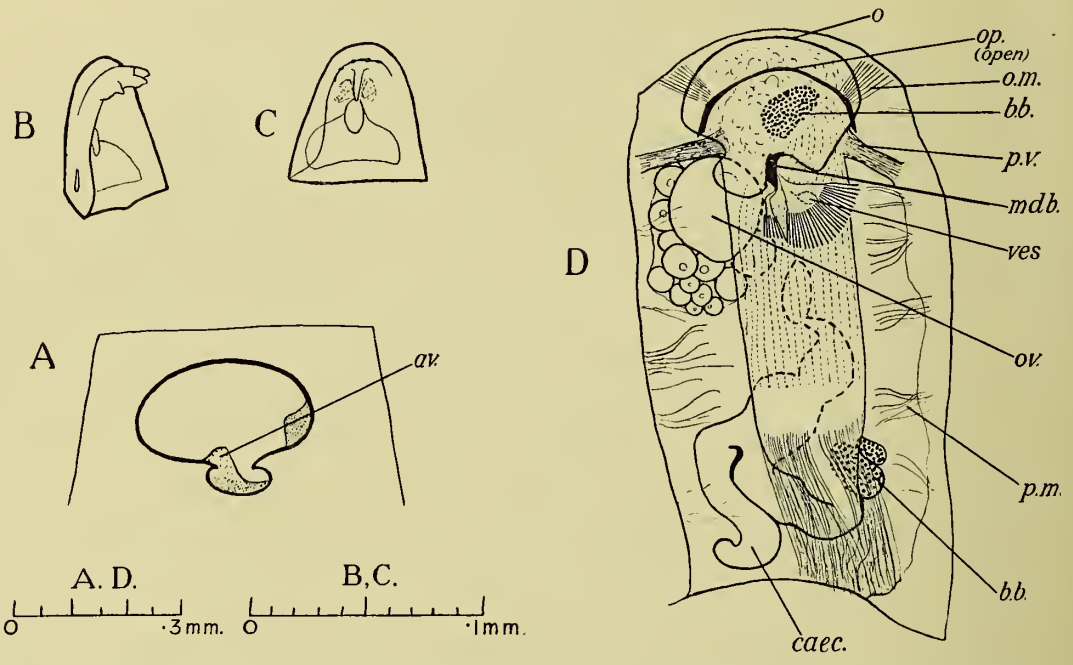
Petralia litoralis, Livingstone MS.

? *Petralia elongata*, Canu and Bassler, 1929, p. 259, pl. xxiv, fig. 8.

Occurrence.—Low Isles (shore), off N. Anchorage.

Type.—Specimen from shore (B.M. 32.4.20.61).

Description.—The colony is unilamellar, and brown coloured even when preserved. In life the specimens were a chocolate-brown colour. The shore specimens are loosely encrusting, and were found under dead coral; the dredged one is unattached.



Text-fig. 15.—*Petralia litoralis*, Livingstone, sp. n. A, Orifice seen from within. Primary orifice thickly outlined, peristome and avicularium stippled. B, C, Oral mandible, oblique and basal views. D, Decalcified zooecium. *av.*, Avicularium. *b.b.*, Brown body. *caec.*, Caecum. *mdb.*, Mandible. *o.*, Orifice. *o.m.*, Occlusor muscle. *op.*, Operculum. *ov.*, Ovary. *p.m.*, Parietal muscle. *p.v.*, Parietovaginal muscle. *ves.*, Vesicle.

The orifice is more or less semicircular, with a sinus to one side. The sinus is limited by a pair of hinge teeth, of which one is longer than the other (Text-fig. 15, A). The smaller hinge tooth is almost in the median line and is hidden in frontal view by the oral avicularium. The larger hinge tooth and part of the sinus are visible in frontal view. The avicularium is placed transversely and has a hooked beak. The peristome is nodular and irregular, but forms a small umbo behind the avicularium. The ovicell has the usual finely punctured ectooecium. The ectooecium, which is uncalcified in young zooecia, becomes very unevenly calcified, sometimes forming radial calcareous bands (Plate I, fig. A).

On some zooecia there is a small, transverse, ligulate avicularium on the frontal wall (Plate I. fig. A). It is placed laterally and, though raised, is inconspicuous. The calcareous beak is hooked with a finely beaded edge. The mandible of the oral avicularium is bluntly triangular (Text-fig. 15. B, C). It has a toothed flange somewhat resembling that in *P. vultur* var. *serrata*, but more prominent distally. There are bosses for the attachment of the occlusor muscles, with a narrow longitudinal sclerite between them. As in the oral mandible of *P. vultur* var. *serrata*, described above, one of the lateral edges appears to be turned in. In the natural position of the mandible this edge is directed frontally. There is a rather large vesicle between the occlusor muscles (Text-fig. 15, D). Except for its greater length, the mandible of the frontal avicularium is like that of the oral avicularium.

The polypide (Text-fig. 15, D), like that of other Petraliidae, has a large number of long tentacles. The caecum is long and slender. The occlusor muscles of the operculum are attached to the distal wall. The parieto-vaginal muscles take the form of a single broad band on each side. The parietal and retractor muscles are very fine and numerous. There is a single ovary at one side of the zooecium. It has a large number of ova, of which one is usually much larger than the rest.

Remarks.—Since Mr. Livingstone sent me his manuscript, Canu and Bassler's work on the Bryozoa of the Philippine Islands (1929) has been published, describing a large number of species of Petraliidae. Most of their new species differ from *P. litoralis* in possessing a lyrula. Of those that do not, *P. crassocirca* has a symmetrical orifice with a straight proximal border, an unraised peristome, and a rather conspicuous acute avicularium on each side of the orifice. This leaves *P. gigantea*, *P. grandicella* and *P. elongata*. The first two are larger in all their measurements, differ in the number and size of the dorsal radicular pores, and have larger and less numerous frontal pores. In its dimensions and in the size and number of the frontal pores *P. litoralis* resembles *P. elongata*. In *P. litoralis* there may be more than one dorsal pore, there are no avicularia on the "shield," and there may be a frontal avicularium. There are, however, large tracts in which no zooecium has a frontal avicularium. *P. litoralis* is thus very near to *P. elongata*, and, when the characters of *P. elongata* are more fully known, may be found to be synonymous with it.

Rhynchozoon longirostre (Hincks).

Rhynchopora longirostris, Hincks, 1881*c*, p. 125, pl. iv, figs. 7, 8 ; Waters, 1889, p. 19 ; Macgillivray, 1890*b*, pp. 356, pl. cxcvi, figs. 11–14 ; Kirkpatrick, 1890*a*, p. 612 ; Maplestone, 1909, p. 268.
Escharoides verruculata, Busk, 1884, p. 150.
Rhynchozoon longirostris, Hastings, 1930*a*, p. 729, pl. xiv, figs. 89, 90.

Occurrence.—St. II.

Distribution.—Australia, Heard Island.

There is one small colony of this species. The mandible of the large frontal avicularium sometimes extends beyond the beak and is somewhat expanded distally, but the beak is of the usual form. In all other respects the specimen is typical.

Retepora graeffei (Kirchenpauer).

Retihornera graeffei, Kirchenpauer, 1869, p. xxx.
Retepora producta, Busk, 1884, p. 108, pl. xxv, fig. 7 ; Waters, 1913, p. 525, pl. lxxii, figs. 9, 10 (synonymy); Marcus, 1922, p. 433.
Retepora graeffei, Marcus, 1921*a*, p. 15 ; Livingstone, 1927, p. 59.

Occurrence.—Box sunk in Anchorage, collected 29.v.29; N.W. Low Is.; off N. Anchorage; St. XII, XIV, XXVI.

Distribution.—N. Australia, Oceania, Indian Ocean.

This is *R. producta*, Busk. Following Marcus and Livingstone, Kirchenpauer's name is used, although the identity of Kirchenpauer's species with Busk's cannot be regarded as finally proved till the type has been examined. The specimen of *R. producta* in the British Museum, regarded by Waters as possibly the type of *R. graeffei*, is probably not the holotype. It is one of the specimens offered for sale (Mus. Godeffroy Cat. IV, p. 119, no. 3919), and was bought by the British Museum. On the title-page of Cat. III it is stated that the specimens for sale are duplicates and, as only two of the six species of *Retihornera* described by Kirchenpauer are offered for sale (Cat. IV, p. 119), it may be assumed that a series of specimens was retained in Hamburg. If so, these must be regarded as the holotypes.

Retepora monilifera var. *munita*, Hincks.

Retepora monilifera var. *munita*, Hincks, 1878, p. 361, pl. xix, fig. 5; Marcus, 1921*a*, p. 16, pl. i, figs. 6, 7; Livingstone, 1927, p. 58; 1928, p. 117.

Retepora monilifera form *munita*, MacGillivray, 1884*a*, p. 108, pl. i, fig. 3; 1885*b*, p. 22, pl. xciv, fig. 4, pl. xcvi, figs. 4–8; 1890*c*, p. 6; Kirkpatrick, 1890*a*, p. 612; Marcus, 1921*b*, p. 14.

Occurrence.—St. II.

Distribution.—Australia, Aru Is.

In these specimens the trabeculae are rather narrow and the fenestrae vary in width, some being a little wider, others narrower than the trabeculae. The vibices are conspicuous and enclose rather large areas. The opercula are longer than broad. They resemble those of *R. monilifera* in being fairly strongly chitinized, but are not wider proximally. The peristome is thick and raised on the older zooecia, forming a rather deep, wide sinus which frequently has an avicularium at one corner. These avicularia may have a very broad, short mandible, considerably less than a semicircle, with strong sclerites and a beaded edge, or a longer, less chitinized blunt mandible, as figured by Macgillivray (1884*a*, pl. i, fig. 4, small mandible on right). Both types of avicularia also occur on the frontal surface of the zooecia and on the edges of the fenestrae. The large suprafenestral avicularium has a strongly curved pointed mandible. The central part of the blade is thicker but without definite sclerites. The lateral thinner parts of the blade widen to form a blunt point on each side, thus differing from Macgillivray's figure, in which the mandible tapers uniformly. When the mandible is closed, the two points of the calcareous beak stand up between these lateral points and the terminal point. Similar avicularia occasionally replace the small ones on the frontal surface of the zooecia. They also occur on the basal surface, but here they are very flat. Those on the frontal surface have a prominent avicularian chamber. The ovicells are considerably taller than broad. The stigma is correspondingly elongated, sometimes the median arm, sometimes the two proximal ones being the longest. The angle between the proximal arms is acute. In Hincks's specimen of *munita* from Port Phillip Heads (B.M. 99.5.1.1257) the suprafenestral avicularium is larger, and the plane of its opesia is nearly at right angles to the plane of the mandible when closed.

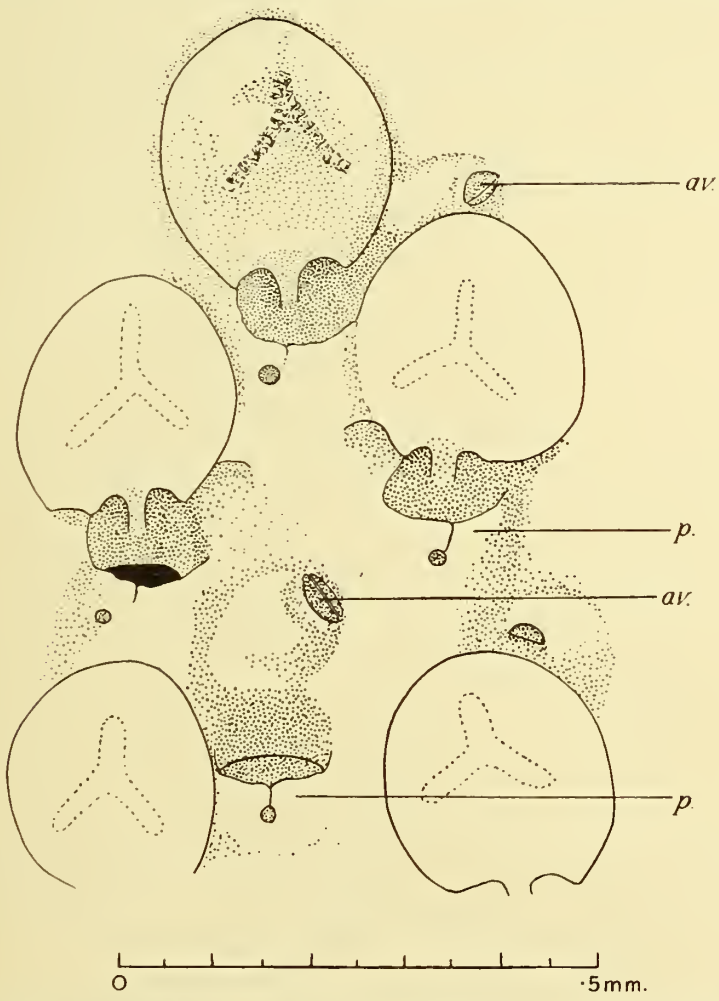
Retepora monilifera var. *benemunita* (Busk), var. nov. (Plate I, fig. E ; Text-figs. 16, 17.)

Retepora benemunita, Busk MS.

Occurrence.—Australia (Busk Coll., B.M. 99.7.1.70, 71, 2930, 2952–2956, 4854 ; 82.7.29.82) ; Low Is., 12 fath. : off N. Anchorage ; St. II, XII.

Type.—B.M. 99.7.1.70.

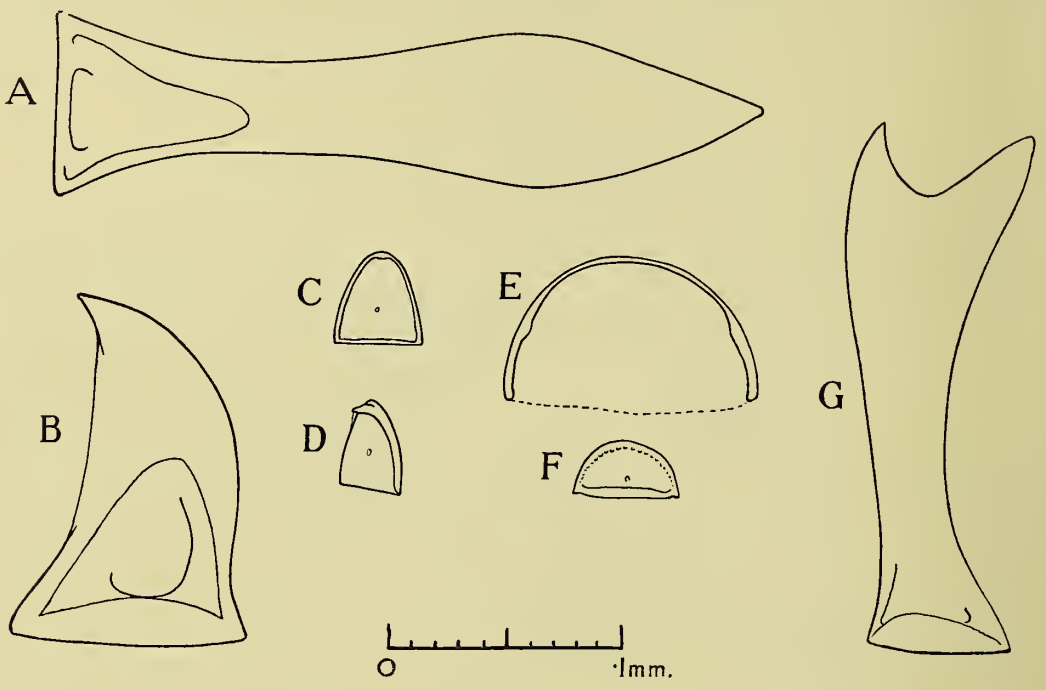
The type-colony (Plate I. fig. E) consists of irregular tubular meshes with the zooecia on their inner surface. In the Barrier Reef specimens the tubes may have a greater



Text-fig. 16.—*Retepora monilifera* var. *benemunita* (Busk) var. n. Part of Barrier Reef specimen treated with Eau de Javelle and seen by reflected light. *av.*, Avicularium. *p.*, Peristome.

diameter, and occasionally the zooecia are on the outer surface. The fenestrae are regular, and usually a little narrower than the trabeculae. The dorsal surface has distinct vibices outlining rather large areas. The zooecia (Text-fig. 16) are very regularly arranged, and are rather long and narrow. They are thin-walled, and the peristome is thin and rather prominent. The two sides are united, making it very even in height, and leaving a pore. There may be a fine spine on each side of the orifice. The operculum is almost semicircular (Text-fig. 17, E). The peristome bears a triangular avicularium, whose mandible has a slightly down-turned point, and there may be a semicircular avicularium on the frontal wall (Text-fig. 17, C, D, F). In the type a few larger and more prominent avicularia with a

pointed, strongly curved mandible (Text-fig. 17, B) are found on both the frontal and the basal surface. These have not been found in the Barrier Reef specimens. There may be a raised avicularium directed into the proximal angle of the fenestra as in *R. tubulata*. Its mandible is bifid (Text-fig. 17G), and somewhat variable in shape; as a rule, however, its ends are shorter and less sharply pointed than those of *R. tubulata*. A few of these fenestral avicularia are present in the type, and they are common in other specimens. On the basal surface there are a few large avicularia with a long narrow mandible (Text-fig. 17, A), those of the Barrier Reef specimens being longer and narrower than those of the type. There are also small round ones bordering the fenestrae. The ovicells are prominent, and may be more or less spherical or a little longer than broad (Text-fig. 16). The longitudinal arm of the stigma is usually the shortest. The oral glands are rather conspicuous.



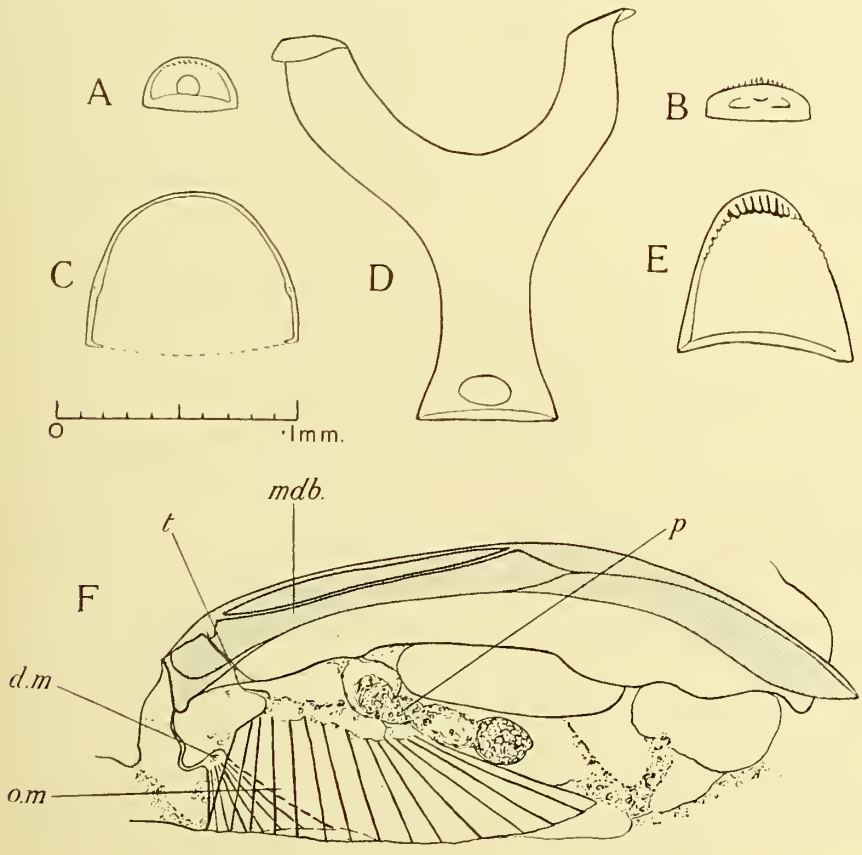
TEXT-FIG. 17.—*Retepora monilifera* var. *benemunita* (Busk), var. n. Chitinous parts of type. A, Mandible of large basal avicularium. B, Mandible of large triangular avicularium, oblique view. C, D, Oral mandible, frontal and oblique views. E, Operculum. F, Mandible of small frontal avicularium. G, Mandible of fenestral avicularium, oblique view.

The specimen from St. II differs in some ways. It agrees in the shape of the operculum and oral avicularium and in the presence of the bifid, proximal, fenestral avicularium. The peristome is thickened and somewhat pointed above the oral avicularium. The ovicell is slightly umbonate. There are a few large avicularia placed above the fenestra as in var. *munita*, but they have a bifid mandible, and the calcareous beak has three sharp points between which the tips of the mandible lie when it is closed. The mandible is long and slender, with long sharp points. As in var. *munita*, it is occasionally replaced by a highly chitinized semicircular mandible. The proximal fenestral avicularia are rather small and not very numerous in this specimen.

One specimen from St. XII has the characteristic zooecia, opercula and oral avicularium, but has no large fenestral avicularia. It has no ovicells. A dead specimen from the same station has the characteristic basal and fenestral avicularia.

Remarks.—This form is clearly allied to *R. monilifera*, but differs from the described varieties in the pointed oral avicularium, and, from most of them, in having an operculum that is wider than high (see Macgillivray, 1885*b*, pl. xciv, figs. 1, 2, 4, 5, though Marcus, 1921*a*, p. 17, regards the wide operculum as characteristic of the group). These two peculiarities, associated with the presence of a bifid fenestral avicularium and the general characteristics of the zooecia and ovicells, make necessary the introduction of a new name, which for the sake of uniformity with the present nomenclature in the *R. monilifera*-group may be regarded as designating a variety of *R. monilifera*. As the form was clearly recognized by Busk, under the manuscript name of *R. benemunita*, I have used that name and chosen one of Busk's two colonies as the holotype. In the Barrier Reef specimens collected in September, October and November, reproduction appears to be at its height, for the body cavities contain abundant eggs and sperm. In the specimens collected in February very few reproductive bodies have been seen. These colonies, in which the almost spherical oral glands are large and conspicuous, may have been formed from larvae produced the same summer.

Retepora tubulata, Busk. (Text-fig. 18.)



Text-fig. 18.—*Retepora tubulata*, Busk. A–E, Chitinous parts of type-specimen. F, Decalcified fenestral avicularium from Barrier Reef specimen, side view, mandible stippled. A, B, Mandible of semicircular avicularium, frontal and distal views. C, Operculum. D, Mandible of fenestral avicularium. E, Mandible of triangular avicularium. *d.m.*, Divaricator muscle. *mdb.*, Mandible. *o.m.*, Occlusor muscle. *p.*, Rudimentary polypide ? *t.*, Tendon of occlusor muscle.

Retepora tubulata, Busk, 1884, p. 121, pl. xxviii, fig. 2, text-fig. 32 ; MacGillivray, 1887*a*, p. 184 ; Thornely, 1905, p. 125 ; 1907, p. 193.
? *Retepora tubulata* var. Waters, 1913, p. 526.

Occurrence.—St. II.

Distribution.—Cape York, Malaya, Ceylon, Zanzibar ?

Busk's figures do not show his usual accuracy, so the chitinous parts have been drawn again from his preparation (Text-fig. 18, A–E). It will be seen that the sides of the operculum are not curved inwards proximally, that the teeth on the triangular avicularia are large and closely set, and that the semicircular avicularia are also toothed. Except for variation in size of the triangular avicularia, the chitinous parts of the Barrier Reef specimen agree with them, but there are in addition a few avicularia on the margins of the fenestrae with very thin, semi-elliptic mandibles. The Barrier Reef colony has not begun to form the tubes characteristic of the zoarium of *R. tubulata*. It is young, but its growth has extended beyond the point where the tubular structure begins in the type. There is a fine spine on each side of the orifice. The "boat-shaped" avicularium (Text-fig. 18, F) is present in most of the fenestrae. The larger frontal avicularia are raised on short stout columns resembling the much taller and more numerous ones of *R. columnifera* (Busk, 1884, pl. xxvi, fig. 5*c*), which is very closely allied if not synonymous. It is difficult to know what Busk meant by the " numerous solid or tubular, calcareous, columnar processes, springing from the dorsal surface " for attachment in *R. columnifera*. Only two are visible in the type, and they do not differ from the secondary attachments of other *Reteporidae* (see Buchner, 1924, p. 160, text-fig. A).

Eggs and sperm can be seen in the body-cavities, and in some zooecia a pair of oral glands has been observed.

Holoporella mamillata (Busk). (Text-fig. 19, A–D.)

Cellepora mamillata, Busk, 1854, p. 87, pl. cxx, figs. 3–5 ; Hincks, 1881*a*, p. 267 ; Waters, 1887, p. 197 ; Philipps, 1899, p. 440 ; Thornely, 1912, p. 155 ; Marcus, 1921*b*, p. 18.

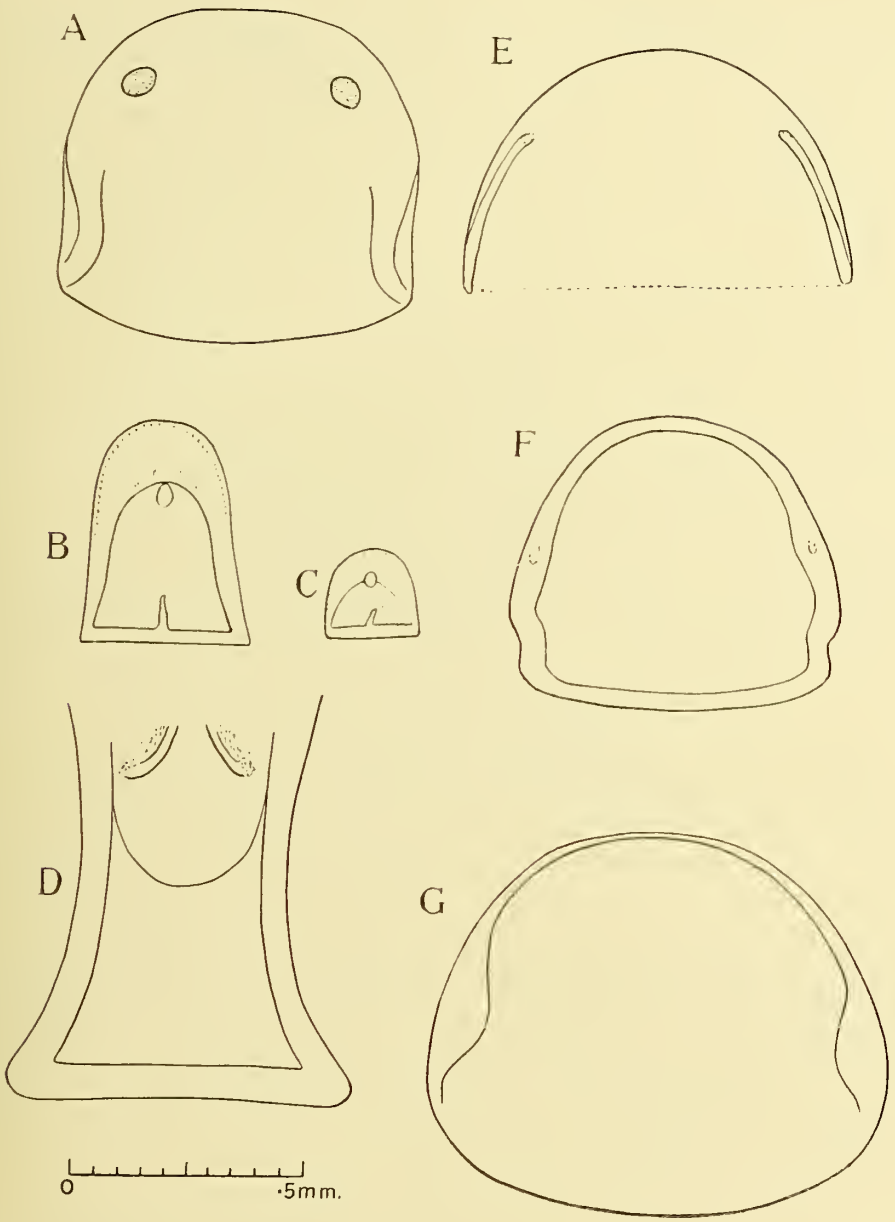
Occurrence.—Low Is., 12 fath. ; St. XIII, XXII.

Distribution.—Australia, Malaya, Loyalty Islands, Indian Ocean, Patagonia.

These specimens agree very exactly with the type of *H. mamillata*. Busk (1884, p. 199) did not find the large "retentive" avicularia in Australian specimens, but a few are present in those from the Barrier Reef and are exactly like those of the type, the base of one of which is shown in Text-fig. 19, D. The spatulate and semicircular avicularia are like those of the type (Text-fig. 19, B, C), and show similar variation in the size of the lucida and the length of the columella. They have a delicate terminal flange, with a finely toothed edge. The spatulate mandibles vary a good deal in size. In the Barrier Reef specimens the opercula are a little larger and the lateral sclerite reaches the muscle attachment, which it can rarely be seen to do in the type (Text-fig. 19, A). This, the only distinction noted, can hardly be regarded as a specific difference. The muscle attachments in the type and the present specimens are nearer the distal end of the operculum than in the allied species.

The oral glands of the specimen from St. XXI resemble those described by Waters in species of *Holoporella* (1909, p. 165 ; 1913, p. 522, pl. lxxiii, fig. 11), being long and thin-walled, with homogeneous contents. Similar glands can be seen in Busk's preparation of *H. hastigera*.

A specimen from the Barrier Reef sent by Mr. Livingstone as *H. pigmentaria*, Waters (1909, p. 163), is the species here regarded as *H. mamillata*. The true *H. pigmentaria* appears to be more nearly allied to *H. mamillata* var. *atlantica*, Busk (1884, p. 199), which



Text-fig. 19.—*Holoporella*. Chitinous parts of: A–D, *H. mamillata* (Busk), type-specimen. E, *H. mamillata* var. *atlantica* (Busk), Challenger Coll., St. 148. F, *H. albirostris* (Busk), Challenger Coll., St. 151. G, *H. albirostris* (Hincks), Bass Strait.

differs from typical *H. mamillata* in its operculum (Text-fig. 19, E). *H. pigmentaria*, which is described as resembling *H. mamillata* except for its operculum, has a similar operculum to that of var. *atlantica*, and might be expected to be synonymous with it. No columella is, however, shown in Waters's figures of the mandibles. *H. mamillata* may sometimes

have been confused with other pigmented Australian species, such as *H. albirostris*—a name which appears to have been given to two Australian species, both of which may be distinct from *H. albirostris* (Smitt, 1873, p. 70) from the Gulf of Mexico.

A specimen from the Tortugas (B.M. 31.12.19.35) appears to be Smitt's species. It differs from Smitt's description in its colourless opercula, but the degree of pigmentation in the dark species of *Holoporella* is variable, and the range of size of the orifice given by Smitt shows that he did not distinguish the large *H. magnifica*, Osburn (1914, p. 216), in which the opercula are black. The opercula of this Tortugas specimen of *H. albirostris* agree in size and shape with that figured by Canu and Bassler (1928*b*, p. 142, text-fig. 31A, B), but I have not seen the type shown in text-fig. 31C. The spatulate avicularia have a columella. *H. albirostris* (Busk, 1884, p. 193) has opercula (Text-fig. 19, F) and oral avicularia of a different shape. Canu and Bassler suggested that the difference in the opercula might be explained by distortion in Busk's preparation, but examination of the type slide shows that their shape is so regular and constant that one cannot suppose them to be distorted. The Mexican *H. albirostris* (Smitt) is therefore distinct from *H. albirostris* (Busk), though a specimen from Sydney (B.M. 62.2.4.35), believed to be the one mentioned by Smitt (1873, p. 70), agrees with *H. albirostris*, Busk. *H. albirostris* (Hincks, 1881*a*, p. 267), from Bass Strait, is represented in the British Museum (82.7.29.3 ; 99.7.1.3213, 3214, 3287) by specimens sent by Hincks to Busk, who (1881*b*, p. 362, explanation pl. xxvi ; 1884, p. 193, synonymy) recognized their distinctness from his own species. *H. albirostris* (Hincks) differs from both Smitt's and Busk's species of that name in its opercula (Text-fig. 19G). They are larger and have no lateral sinuation. The lateral sclerite is thickened to form a rather knob-like flange, and the occlusor muscle is attached just distally to this thickening. A specimen from New Zealand (B.M. 75.1.5.51) also belongs to this species.

Busk (1881*a*, p. 344) distinguished *H. hastigera* from *H. albirostris* chiefly by the absence of spines. Examination of the types shows that their chitinous parts agree exactly, and that, although no spines can be seen in *H. hastigera*, some have been formed, for their basal chitinous joints remain. *H. hastigera* and *H. albirostris* (Busk) are thus probably synonymous as suggested by Waters (1885, p. 305), and should be called *H. hastigera*. The type-colonies of both species have ridges of the kind which, in its extreme development, gives *H. lirata* (Macgillivray, 1888, p. 250) its characteristic appearance.

Marcus (1921*a*, p. 24) has remarked on the improbability of *H. mamillata* being unknown to Macgillivray, and suggests that *H. verrucosa* (Macgillivray, 1888, p. 245) may be a synonym. It differs, however, in the shape of the operculum. A specimen in the Cambridge Museum determined by Macgillivray as *C. albirostris*, Smitt, appears to be *H. albirostris*, Busk (*H. hastigera*).

Holoporella intermedia (Macgillivray). (Text-fig. 20.)

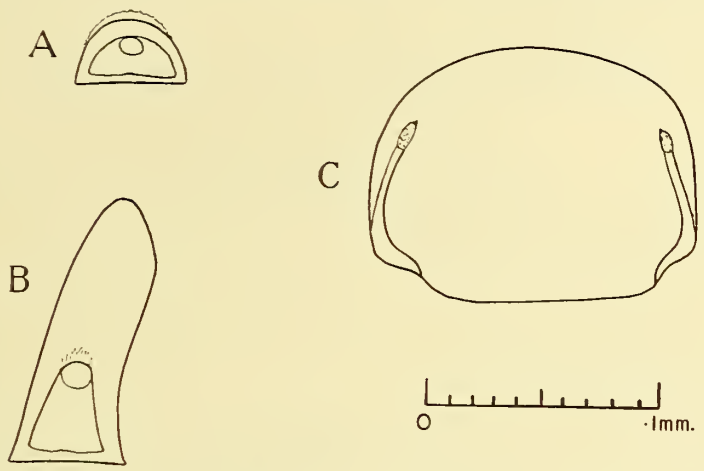
Cellepora intermedia, Macgillivray, 1869, p. 137 ; 1888, p. 247, pl. 166, fig. 3.

Occurrence.—Off N. Anchorage.

Distribution.—Queenscliff.

This unattached, irregularly mamillated, laminate colony, measuring $1\frac{1}{2}$ in. by $\frac{3}{4}$ in., agrees with Macgillivray's description, except that the spatulate avicularia are not spoon-shaped, or specially large (Text-fig. 20, B).

The orifice is semicircular, with a rather conspicuous condyle at the proximal end of each side. The operculum (Text-fig. 20, c) is broader than long, and concave and a little thickened opposite the condyles. Many zooecia have no avicularium; others have a small



Text-fig. 20.—*Holoporella intermedia* (Macg.). A, Semicircular mandible, slightly distal view. B, Spatulate mandible, oblique view. C, Operculum.

one (Text-fig. 20, A) on a low eminence proximal to the orifice. In some parts of a colony in the Cambridge Museum these low eminences are developed into tall columnar processes. The zooecia of this colony also differ in having a slightly larger orifice.

Holoporella fusca (Busk).

Cellepora fusca, Busk, 1854, p. 88, pl. cxix, fig. 2; cxx, fig. 6; 1881*b*, pl. xxvi, fig. 11; 1884, pl. xxxv, fig. 14; Maplestone, 1882, p. 51; Macgillivray, 1888, p. 249, pl. clxvii, fig. 2; pl. clxviii, fig. 16; Kirkpatrick, 1890, p. 612.

Holoporella fusca, Waters, 1909, p. 161; Marcus, 1921*a*, p. 24, pl. i, figs. 11, 11*a*; Livingstone, 1927, p. 65.

Occurrence.—St. XXII.

Distribution.—Australia.

These specimens correspond exactly to Busk's description, figures and type-specimens. Macgillivray (1888, p. 249) had specimens which differed in having the spatulate avicularia directed upwards on the sides of conical rostra. In the type and in the Barrier Reef specimens the mandible is parallel to the surface of the colony.

Holoporella tridenticulata (Busk).

Cellepora tridenticulata, Busk, 1881*a*, p. 347; 1881*b*, pl. xxvi, fig. 9; 1884, p. 198, pls. xxix, fig. 3; xxxv, fig. 17; Macgillivray, 1890*c*, p. 6.

Holoporella tridenticulata, Thornely, 1912, p. 155; 1916, p. 164; Robertson, 1921, p. 61; Livingstone, 1927, p. 65; Canu and Bassler, 1930, p. 39, pl. vii, figs. 2 and 3 (references).

Occurrence.—St. XII, XIII.

Distribution.—Australia, Indian Ocean, Galapagos Islands.

This specimen agrees exactly with the type-specimen. The curious tubes mentioned by Busk, Thornely (1912), and Canu and Bassler, contain Spionid Polychaets, probably belonging to the genus *Polydora*. A similar Polychaet can be seen in one of the type-slides (B.M. 82.7.29.20).

Catenaria lafontii (Audouin).

Eucratea lafontii, Audouin, 1826, p. 242 ; Savigny, pl. xiii, figs. 2^{1-7}.
Catenaria lafontii, Hastings, 1927, p. 346 (references) ; 1930*a*, p. 732.
Savignyella lafontii, Osburn, 1927, p. 126.

Occurrence.—St. XVI.

Distribution.—Indian Ocean, Mediterranean, Atlantic, E. Pacific.

Vittaticella elegans (Busk).

Catenicella elegans, Busk, 1852*a*, p. 361, pl. i, fig. 2 ; Kirkpatrick, 1890*b*, p. 16 ; Thornely, 1905, p. 109 ; Marcus, 1922, p. 431, pl. xxiv, fig. 7 (references).
Vittaticella elegans, Okada, 1921, p. 27 ; Livingstone, 1927, p. 57 ; 1929, p. 99.

Occurrence.—St. II, VIII, XVI.

Distribution.—Australia, Tasmania (Cambridge Museum), New Zealand, Malaya, Japan, Indian Ocean, Tristan da Cunha.

The Barrier Reef specimens attributed to this species differ from the type-specimens in their slender zooecia, in the small size of their scapular (avicularian) chamber and in the arrangement of the vittae at the bifurcation. In typical *V. elegans* the vitta (" pedal-chamber ") on the adzooecial side of the daughter-zooecium is short, and there is a boundary chamber (Levinsen, 1909, p. 256). In the Barrier Reef specimens the vitta is long, and has an expanded tip occupying the position of the boundary chamber of the type. This arrangement is well figured by Marcus (1922, pl. xxiv, fig. 7), whose specimens from the Aru Islands resembled those from the Barrier Reef. Like some of those from the Barrier Reef, Marcus's specimen had a large transverse avicularium on the adzooecial side of the daughter zooecium at a bifurcation. Other specimens whose zooecia resemble those of the Barrier Reef specimens rather than the type of *V. elegans*, and which possess this avicularium, are those of Waters (1913, p. 484) from Zanzibar, that from the Arafura Sea mentioned by Waters (B.M. 82.2.23.409), and Busk's specimens from S. Africa, mentioned (1852*a*, p. 361) as differing from *V. elegans*, and later (1852*b*, p. 10) identified with it. The existence of specimens only differing from these in the absence of the large avicularia is not surprising. Such are the " Challenger " specimen from St. 188 (Torres Straits), Kirkpatrick's from the same locality (1890*a*, p. 611), Thornely's from Ceylon (1905, p. 109), part of which is in the Cambridge Museum, and some from the Barrier Reef. Others, such as the " Challenger " specimens, except those from St. 188, are more definitely intermediate, and have led me to include both forms in *V. elegans*. They have the slender zooecia and small scapular chamber of the Barrier Reef specimens with the boundary chamber and short vitta of the type.

Macgillivray's description of *V. gracilenta* (1885*a*, p. 106, pl. i, fig. 3), suggests the Barrier Reef form, except that he does not mention a beaded border to the ovicell, or the presence of large avicularia, but his figure, which shows the long vitta on the adzooecial side of the daughter zooecium, represents a larger form. The long stout zooecia, with very wide vittae at the proximal end of his figured specimen, resemble the proximal zooecia of colonies of *V. gibbosa ;* the whole figure might indeed represent a basal portion of a colony of that species. This suggestion is supported by the fact that in the first collection sent to the British Museum by Bracebridge Wilson this species is represented by specimens (B.M. 88.11.14.22, 28) which have a slight indication of the distal ridge of *V. gibbosa*,

and in other respects agree exactly with the type-specimen of that species. Kirkpatrick's specimen of *V. gibbosa* from Torres Straits (B.M. 90.7.23.35) shows that there may be considerable variation in the degree of development of this ridge and of its spines. The supposed specimens of *V. gracilenta* in the second Bracebridge Wilson Collection (B.M. 97.5.1.46–50), received ten years later, are much smaller and more delicate than the species figured by Macgillivray, and have a boundary chamber and short vitta on the daughter zooecium as in typical *V. elegans*.

Another species resembling the Barrier Reef specimens in the long vitta of the daughter zooecium is *V. buskii* (Thomson, 1858, p. 139), of which I have examined part of the type material. It is, however, a larger, stouter species with large, sharply pointed scapular chambers on all but the more basal zooecia. Those of the distal zooecia are specially sharp and frequently are not avicularian. The basal zooecia show most clearly the cylindrical form and short joints described by Thomson. Those more distally placed taper proximally and have slightly longer joints. Marcus (1921*a*, p. 10) suggests that *V. buskii* may be a synonym of *V. gibbosa*, and he may be right. They agree in the size and general shape of the zooecia. *V. gibbosa* shows some tendency to form pointed scapular chambers, but in the material available to me they are shorter and always avicularian. *V. buskii* does not, in my experience, show any tendency to form a distal ridge with spines, and the "bottle-brush" form of its colony is, if constant, another minor distinction between it and *V. gibbosa*, in which such a form has not been found. A large and typical colony of *V. buskii*, recently obtained from the Hong-Kong Manilla cable (B.M. 30.1.9.6), shows this form very well (Plate I, fig. B), consisting of a number of very regular "bottle-brush" shoots branching from a strong stalk.

V. fusca (Macgillivray, 1884*b*, p. 33), which, according to Waters (1913, p. 483, footnote), is a synonym of *V. umbonata*, Busk (1852*b*, p. 11), resembles *V. buskii*, *V. gracilenta* and *V. gibbosa* in its long cylindrical basal zooecia with broad vittae, and in the arrangement of the vittae at a bifurcation. Like them it is larger and stouter than *V. elegans*. All these forms agree in the structure of their ovicells. In Thomson's figure of *V. buskii* the marginal beading appears to be continued across the lip, but this is not so in his specimen. There may be considerable variation, even within the colony, in the size and shape of the frontal uncalcified area, which may be large or small, quadrangular or oval. The marginal "beading" may be only a single row of pores, or there may be a few others scattered on the frontal surface. In this, too, there is individual variation. As both Marcus (1921*a*, p. 9) and Waters (1887, p. 87) expressed some uncertainty as to the meaning of Busk's statement that the "ooecial cell" is geminate, it may be worth remarking that Busk was not referring to the ovicell, but to the fertile zooecium, meaning that the ovicell-bearing zooecium is not separated by a joint from the one distal to it.

APPENDIX.

On a Hydroid Associated with the Polyzoa.

Zanclea protecta, Hastings.

Zanclea protecta, Hastings, 1930*b*, p. 552, text-figs. 1–6.

Occurrence.—Low Is., 12 fath., and N.E. Low Is. on *Schizomavella australis* ; off N. Anchorage on *Petralia litoralis* ; St. II on *Retepora tubulata* ; XIV on *Retepora graeffei* ; XXI on *Holoporella mamillata* ; IX on *Holoporella tridenticulata.*

Distribution.—E. Pacific, Tortugas on *Holoporella* spp. (B.M. 31.12.19.34.35).

One would expect the Barrier Reef specimens to belong to the allied species from Torres Straits, *Coryne cylindrica*, Kirkpatrick (1890*a*, p. 605), rather than *Z. protecta* from the Pacific. The type-material of *C. cylindrica* has, besides nematocysts resembling those of *Zanclea protecta*, considerable numbers of large ones of a different type. Their capsule measures ·032 × ·016 mm. and the thread is stout, about three times as long as the capsule, and spirally barbed. No such nematocysts are to be found in either the type-specimens of *Zanclea protecta* or the Barrier Reef specimens, which agree with the type-specimens exactly. The colony on *Retepora tubulata* commonly has a small medusa-bud in the angle between the hydranth and the hydrorhiza, thus differing slightly from the others.

The " parenchymatous cords " described by Waters (1888, p. 21, pl. iii, figs. 10, 10*a*) in *Retepora columnifera* from Torres Straits prove on examination of his slide (B.M. 89.12.12.2) to be the hydrorhiza of a hydroid of this type, typical hydranths also being present. Both hydranths and hydrorhiza contain large nematocysts resembling those of *C. cylindrica* except for their slightly smaller size, ·021 to ·017 × ·01 mm. It is presumably to be identified with *C. cylindrica.* The relation of the hydroid to the *Retepora* resembles that of *Zanclea protecta* to its host. Harmer (1909, p. 721 ; 1915, p. 12) discovered such an association of a Hydroid and *Retepora* in specimens from Malaya.

Kirkpatrick described *C. cylindrica* as forming a slender network on the basal surface of the Polyzoan and connected with the " heads of the hydroid " which projected from the frontal surface. Waters (1910, p. 254 ; 1913, p. 505) described a similar arrangement of a hydroid associated with *H. pigmentaria*, and concluded that the *Holoporella* had grown over and round established colonies of a free-living hydroid. No trace of a basal network has been found on any Polyzoa bearing *Zanclea protecta.*

Calcareous tubes similar to those described and figured (Hastings, 1930*b*) are frequently to be seen when examining Polyzoa, but in dry material the presence of the hydroid cannot be proved. The calcareous cups have not been seen in any species except *Smittina crosslandi*, but a small dry specimen of that species recently received from Ecuador (B.M. 31.12.8.2) bears two very much like those on the type.

REFERENCES.

Annandale, N. 1922. The Marine Element in the Fauna of the Ganges. Bijdr. Dierk. Amsterdam, XXII, pp. 143–154.

Audouin, V. 1826. Explication sommaire des Planches de Polypes de l'Égypte et de la Syrie. Déscription de l'Égypte, Hist. nat. I, 4, pp. 225–244.

Buchner, P. 1924. Studien über den Polymorphismus der Bryozoen. Zool. Jahrb. Jena, Syst. XLVIII, pp. 155–216, 3 pls., 21 text-figs.

Busk, G. 1852*a*. An Account of the Polyzoa and Sertularian Zoophytes. Appendix (59 pp., 1 pl.) to J. Macgillivray, Narrative of the Voyage of H.M.S. "Rattlesnake," I.

—— 1852*b*. Catalogue of Marine Polyzoa in the Collection of the British Museum, I. Cheilostomata (part). London.

—— 1854. Catalogue of Marine Polyzoa in the Collection of the British Museum, II. Cheilostomata (part).

—— 1860. Catalogue of the Polyzoa collected by J. Y. Johnson, Esq., at Madeira. . . . Quart. J. Micr. Sci., London, VIII, pp. 280–285, 2 pls.

—— 1879. Polyzoa, in Zoology of Kerguelen Island. Philos. Trans. London, CLXVIII, pp. 193–199, 1 pl.

—— 1881*a*. Descriptive Catalogue of the Species of *Cellepora* collected on the Challenger Expedition. J. Linn. Soc., London, XV, pp. 341–356.

—— 1881*b*. Supplementary Note respecting the Use to be made of the Chitinous Organs in the Cheilostomata in the Diagnosis of Species, and more particularly in the Genus *Cellepora*. J. Linn. Soc. London, XV, pp. 357–362, 2 pls.

—— 1884. The Cheilostomata. Rep. Zool. Chall. Exp. XXX.

—— 1886. Cyclostomata, Ctenostomata, Pedicellinea. Rep. Zool. Chall. Exp. L.

Calvet, L. 1900. Contributions à l'Histoire naturelle des Bryozoaires ectoproctes marins. Montpellier.

—— 1904. Bryozoen. Hamburger Magalhaenische Sammelreise, pp. 1–45, 3 pls.

Canu, F., and Bassler, R. S. 1917. A Synopsis of American Early Tertiary Cheilostome Bryozoa. Bull. U.S. Nat. Mus. XCVI, pp. 1–87, 6 pls.

—— 1920. North American Early Tertiary Bryozoa. Bull. U.S. Nat. Mus. CVI, pp. 1–897, 162 pls., 279 text-figs.

—— 1922. Studies on Cyclostomatous Bryozoa. Proc. U.S. Nat. Mus. LXI, 22, pp. 1–160, 28 pls., 40 text-figs.

—— 1923. North American Later Tertiary and Quaternary Bryozoa. Bull. U.S. Nat. Mus. CXXV, pp. 1–301, 47 pls., 38 text-figs.

—— 1927*a*. Classification of the Cheilostomatous Bryozoa. Proc. U.S. Nat. Mus. LXIX, 14, pp. 1–42, 1 pl.

—— 1927*b* and 1928*a*. Bryozoaires des Îles Hawaï. Bull. Soc. Sci. Seine-et-Oise, fasc. 7, suppl., pp. 1–66, 11 pls.

—— 1928*b*. Fossil and Recent Bryozoa of the Gulf of Mexico Region. Proc. U.S. Nat. Mus. LXXII, 14, pp. 1–199, 34 pls., 35 text-figs.

—— 1928*c*. Bryozoaires du Brésil. Bull. Soc. Sci. Seine-et-Oise, IX, 5, pp. 58–110, 9 pls.

—— 1929. Bryozoa of the Philippine Region. Bull. U.S. Nat. Mus. 100, 9, pp. 1–685, 94 pls., 224 text-figs.

—— 1930. The Bryozoan Fauna of the Galapagos Islands. Proc. U.S. Nat. Mus. LXXVI, 13, pp. 1–78, 14 pls., 13 text-figs.

Ehlers, E. 1890. Zur Kenntnis der Pedicellineen. Abh. Ges. Wiss. Göttingen, Phys. Kl. XXXVI, pp. 3–200, 5 pls., 7 text-figs.

Goddard, E. J. 1910. Contribution to our Knowledge of Australian Hirudinea, IV. With a Note on a Parasitic Entoproctous Polyzoon. Proc. Linn. Soc. N.S.W. XXXIV, pp. 721–732, 3 pls., 2 text-figs.

Goldstein, J. R. Y. 1880. Notes on Living Polyzoa. J. Micr. Soc. Vict. I, pp. 42–50.

Gray, J. E. 1848. List of the Specimens of British Animals in the Collection of the British Museum, I. Centroniae or Radiated Animals.

Haeckel, E. 1873. Ueber einige neue pelagische Infusorien. Jena. Z. Naturw. VII, pp. 561–568, 2 pls.

Harmer, S. F. 1900. A Revision of the Genus Steganoporella. Quart. J. Micr. Sci. XLIII, pp. 225–297, 2 pls.

HARMER, S. F. 1902. On the Morphology of the Cheilostomata. Quart. J. Micr. Sci. London, XLVI, pp. 263–350, 4 pls.
—— 1909. Presidential Address, Section D. Rep. Brit. Assoc. Adv. Sci. London, 1908, pp. 715–731.
—— 1915. Entoprocta, Ctenostomata, Cyclostomata. Rep. Siboga Exp. XXVIII*a*.
—— 1926. Cheilostomata Anasca. Rep. Siboga Exp. XXVIII*b*.
—— 1930. Polyzoa. Proc. Linn. Soc. London, CXLI, pp. 68–118, 1 pl., 11 text-figs.
HASSALL, A. H. 1842. Remarks on the Genus *Lepralia* of Johnston with Descriptions of Six undescribed Species. Ann. Mag. Nat. Hist. IX, pp. 407–414.
HASTINGS, A. B. 1927. Report on the Polyzoa. Camb. Exp. Suez Canal. Trans. Zool. Soc. London, pt. 3, pp. 331–354, 7 text-figs.
—— 1930*a*. Cheilostomatous Polyzoa from the Vicinity of the Panama Canal. . . . Proc. Zool. Soc. London, 1929, part 4, pp. 697–740, 17 pls.
—— 1930*b*. On the Association of a Gymnoblastic Hydroid (*Zanclea protecta*, sp. n.) with various Cheilostomatous Polyzoa from the Tropical E. Pacific. Ann. Mag. Nat. Hist. 10, V, pp. 552–560, 6 text-figs.
HASWELL, W. A. 1881. On Some Polyzoa from the Queensland Coast. Proc. Linn. Soc. N.S.W. V, pp. 33–44, 3 pls.
—— 1892. Observations on the *Chloraemidae*, with special reference to certain Australian forms. Proc. Linn. Soc. N.S.W. VI, pp. 329–356, 3 pls.
HINCKS, T. 1877. On British Polyzoa, II. Ann. Mag. Nat. Hist. 4, XX, pp. 520–532.
—— 1878. Notes on the Genus *Retepora* with Descriptions of New Species. Ann. Mag. Nat. Hist. 5, I, pp. 353–365, 2 pls.
—— 1879. On the Classification of the British Polyzoa. Ann. Mag. Nat. Hist. 5, III, pp. 153–164.
—— 1880. A History of the British Marine Polyzoa. London.
—— 1881*a*. On a Collection of Polyzoa, from Bass's Straits. . . . Proc. Lit. Phil. Soc. Lpool. XXXV, pp. 249–270.
—— 1881*b*. Contributions towards a General History of the Marine Polyzoa, IV and V. Ann. Mag. Nat. Hist. 5, VII, pp. 147–161, 3 pls.
—— 1881*c*. *Op. cit.* VI and VII. Ann. Mag. Nat. Hist. 5, VIII, pp. 1–14, 122–136, 9 pls.
—— 1882. *Op. cit.* X. Ann. Mag. Nat. Hist. 5, X, pp. 160–170, 2 pls.
—— 1884*a*. *Op. cit.* XII, XIII. Ann. Mag. Nat. Hist. 5, XIII, pp. 356–369, 2 pls.
—— 1884*b*. *Op. cit.* XIII (cont.). Ann. Mag. Nat. Hist. 5, XIV, pp. 276–285, 2 pls.
—— 1887. On the Polyzoa and Hydroida of the Mergui Archipelago. . . . J. Linn. Soc. London, XXI, pp. 121–135, 1 pl.
—— 1891. Contributions towards a General History of the Marine Polyzoa, XV. Ann. Mag. Nat. Hist. 6, VII, pp. 285–298, 2 pls.
JOHNSTON, G. 1847. A History of British Zoophytes, ed. 2. London.
JOHNSTON, T. H., and WALKER, M. J. 1917. A New Species of *Pedicellina* from Sydney Harbour. Proc. Roy. Soc. Queensl. XXIX, pp. 60–63, 1 text-fig.
JULLIEN, J. 1888. Bryozoaires. Miss. Sci. Cap Horn, 1882–1883, Zool. VI, pp. 1–92, 15 pls.
KIRCHENPAUER, G. H. 1869. Neue Bryozoen. Mus. Godeffroy Cat. IV, pp. xxv–xxxiv.
KIRKPATRICK, R. 1888*a*. Polyzoa of Mauritius. Ann. Mag. Nat. Hist. 6, I, pp. 72–84, 4 pls.
—— 1888*b*. Polyzoa from Port Phillip. Ann. Mag. Nat. Hist. 6, II, pp. 12–21, 1 pl.
—— 1890*a*. Reports on the Zoological Collections made in Torres Straits. . . . Hydroida and Polyzoa. Sci. Proc. R. Dublin Soc. VI, pp. 603–626, 4 pls.
—— 1890*b*. Hydrozoa and Polyzoa from the China Sea. Ann. Mag. Nat. Hist. 6, V, pp. 11–24, 3 pls.
LAMARCK, J. B. P. A. DE. 1816. Histoire naturelle des Animaux sans Vertèbres, II.
LAMOUROUX, J. V. F. 1816. Histoire des Polypiers coralligènes flexibles. . . . Caen.
—— 1825. Quoy & Gaimard in Zool. Voy. Uranie, Paris, Polypiers flexibles, pp. 603–643, 7 pls.
LANDSBOROUGH, D. 1852. A Popular History of British Zoophytes, London.
LANG, W. D. 1917. The Genotypes of Certain Polyzoan Genera. Quart. J. Geol. Soc. London, dec. 6, IV, pp. 169–174.
LEVINSEN, G. M. R. 1909. Morphological and Systematic Studies on the Cheilostomatous Bryozoa. Copenhagen.
LINNAEUS, C. 1758. Systema Naturae, ed. 10, I.
LIVINGSTONE, A. A. 1926*a*. Report on the Polyzoa Collected on the Great Barrier Reef, Queensland . . . Rec. Aust. Mus. Sydney, XV, pp. 79–99, 4 pls., 1 text-fig.

Livingstone, A. A. 1926*b*. The Biology of North-West Islet, Capricorn Group. (f) Bryozoa. Aust. Zool. Sydney, IV, pp. 247–248.
—— 1927. A Check List of the Marine Bryozoa of Queensland. Rec. Aust. Mus. Sydney, XVI, 1, pp. 50–69.
—— 1928. Bryozoa from S. Australia. Rec. S. Aust. Mus. Adelaide, IV, pp. 111–124, 5 text-figs.
—— 1929. Bryozoa Cheilostomata of New Zealand. Vidensk. Medd. naturh. Foren. Kjøb. LXXXVII, pp. 45–104, 2 pls., 7 text-figs.
Lonsdale, W. 1845. Report on the Corals from the Tertiary Formations of North America. Quart. J. Geol. Soc. XLV, pp. 495–533, 28 text-figs.
Macdonald, J. D. 1877. On a New Genus of Trematoda and some New or Little-known Parasitic Hirudinei. Trans. Linn. Soc. London, 2, I, pp. 209–212, 1 pl.
Macgillivray, P. H. 1868. Descriptions of some New Genera and Species of Australian Polyzoa; to which is added a list of Species found in Victoria. Trans. Proc. Roy. Soc. Vict. IX, pp. 126–148.
—— 1881. In McCoy, Prodromus of the Zoology of Victoria, dec. VI, pp. 27–46, 4 pls.
—— 1883. Descriptions of New or Little-known Polyzoa, II. Trans. Proc. Roy. Soc. Vict. XIX, pp. 130–138, 3 pls.
—— 1884*a*. Descriptions . . . V. Trans. Proc. Roy. Soc. Vict. XX, pp. 103–112, 3 pls.
—— 1884*b*. In McCoy, Prodromus . . . dec. IX, pp. 29–34, 2 pls.
—— 1885*a*. Descriptions . . . VIII. Trans. Proc. Roy. Soc. Vict. XXI, pp. 106–119, 5 pls.
—— 1885*b*. In McCoy, Prodromus . . . dec. X, pp. 13–31, 6 pls.
—— 1886. Descriptions . . . IX. Trans. Proc. Roy. Soc. Vict. XXII, pp. 128–139, 3 pls.
—— 1887*a*. Descriptions . . . XII. Trans. Proc. Roy. Soc. Vict. XXIII, pp. 179–186, 1 pl.
—— 1887*b*. A Catalogue of the Marine Polyzoa of Victoria. Trans. Proc. Roy. Soc. Vict. XXIII, pp. 187–224.
—— 1888. In McCoy, Prodromus . . . dec. XVII, pp. 241–253, 4 pls.
—— 1889. On some South Australian Polyzoa. Trans. Roy. Soc. S. Aust. XII, pp. 24–30, 1 pl.
—— 1890*a*. Descriptions . . . XIII. Proc. Roy. Soc. Vict. n.s. II, pp. 106–110, 1 pl.
—— 1890*b*. In McCoy, Prodromus . . . dec. XX, pp. 335–357, 2 pls.
—— 1890*c*. An Additional List of South Australian Polyzoa. Trans. Roy. Soc. S. Aust. XIII. pp. 1–7, 1 pl.
—— 1895. A Monograph of the Tertiary Polyzoa of Victoria. Trans. Roy. Soc. Vict. IV, pp. 1–166, 22 pls.
Maplestone, C. M. 1882. Observations on Living Polyzoa. Trans. Proc. Roy. Soc. Vict. XVIII, pp. 48–51, 1 pl.
—— 1902. Further Descriptions of the Tertiary Polyzoa of Victoria, VII. Proc. Roy. Soc. Vict. XIV, pp. 65–74, 3 pls.
—— 1909. The Results of Deep-Sea Investigations in the Tasman Sea. I, 5, The Polyzoa. Rec. Aust. Mus. Sydney, VII, pp. 267–273, 4 pls.
—— 1910. On a New Species of *Cellepora* from the South Australian Coast. Proc. Roy. Soc. Vict. XXIII, pp. 39–41, 3 pls.
Marcus, E. 1921*a*. Bryozoen. K. svenska VetenskAkad. Handl. LXI, 5, pp. 1–34, 2 pls.
—— 1921*b*. Indo-Pacifische Bryozoen aus dem Ryksmuseum in Stockholm. Ark. Zool. Stockholm, XIV, 7, pp. 1–23, 2 pls.
—— 1921*c*. Bryozoen von den Auckland- und Campbell-Inseln. Vidensk. Medd. naturh. Foren. Kjøb. LXXIII, pp. 85–121, 1 pl., 11 text-figs.
—— 1921*d*. Bryozoa von den Juan Fernandez Inseln, in Skottsberg, The Natural History of Juan Fernandez. Zool. III, pp. 93–124, 19 text-figs.
—— 1922. Bryozoen von den Aru Inseln. Abh. senckenb. naturf. Ges. XXXV, pp. 421–446, 2 pls.
Milne-Edwards, H. 1836. Histoire naturelle des Animaux sans Vertèbres, Lamarck, ed. 2, vol. II.
—— 1838. Mémoire sur les Crisies, les Hornères et plusieurs autres Polypes. . . . Ann. Sci. nat. Paris, Zool. IX, pp. 193–238, 11 pls.
Monro, C. C. A. 1931. Polychaeta, Oligochaeta, Echiuroidea and Sipunculoidea. Rep. Gt. Barrier Reef Exp. IV, no. 1, pp. 1–37, 15 text-figs.
Norman, A. M. 1864. On undescribed British Hydrozoa, Actinozoa and Polyzoa. Ann. Mag. Nat. Hist. 3, XIII, pp. 82–90, 3 pls.
—— 1903. Notes on the Natural History of East Finmark. Ann. Mag. Nat. Hist. 7, XII, pp. 87–128, 2 pls.

O'Donoghue, C. H. 1924. The Bryozoa collected by the S.S. "Pickle." Union of S. Africa Fish. and Mar. Biol. Surv. 3 (1922). Spec. Rep. X, pp. 1–63, 4 pls.

Okada, Y. 1921. Notes on Some Japanese Cheilostomatous Bryozoa. Annot. zool. Jap. X, 3, pp. 19–32, 7 text-figs.

d'Orbigny, A. 1850–52. Palèontologie Française. Terrains Crétacés, V.

Ortmann, A. 1889. Die Japanischen Bryozoen fauna. Arch. Naturgesch. Berlin, LVI, pp. 1–74, 4 pls.

Osburn, R. C. 1914. The Bryozoa of the Tortugas Islands, Florida. Pap. Tortugas Lab. Carn. Instn. V, pp. 183–222, 23 text-figs.

—— 1927. The Bryozoa of Curaçao. Bijdr. Dierk. Amsterdam, XXV, pp. 123–131, 7 text-figs.

Pallas, P. S. 1766. Elenchus Zoophytorum.

Philipps, E. G. 1899. Report on the Polyzoa . . . from the Loyalty Islands, New Guinea and New Britain. Willey's Zool. Res. IV, pp. 440–450, 2 pls.

Robertson, A. 1921. Report on a Collection of Bryozoa from the Bay of Bengal and other Eastern Seas. Rec. Ind. Mus. Calcutta, XXII, pp. 33–65, 11 text-figs.

Ritchie, J. 1911. On an Entoproctan Polyzoon (*Barentsia benedeni*) New to the British Fauna, with Remarks on Related Species. Trans. Roy. Soc. Edinb. XLVII, pp. 835–848, 1 pl.

Salensky, M. 1877. Études sur les Bryozoaires entoproctes. Ann. Sci. nat. Paris, Zool. V, no. 3, pp. 1–60, 4 pls.

Sars, M. 1835. Beskrivelser og Iagttagelser, Bergen.

Savigny, J. C. ? date. Déscription de l'Égypte. Polypes, pls. i–xiv, Paris.

Smitt, F. A. 1873. Floridan Bryozoa, II. K. svenska VetenskAkad. Handl. II, 4, pp. 1–83, 13 pls.

Solander, D. 1786. The Natural History of . . . Zoophytes collected . . . by the late John Ellis. London.

Sowerby, J. 1805. British Miscellany, London, VIII.

Thomson, W. T. C. 1858. On New Genera and Species of Polyzoa. . . . Nat. Hist. Rev. London, V, Proc. Societies, pp. 134–147, 5 pls.

Thornely, L. R. 1905. Report on the Polyzoa. Rep. Pearl Oyster Fisheries Gulf of Manaar, IV, pp. 107–130, 1 pl.

—— 1907. Report on the Marine Polyzoa in the Collection of the Indian Museum. Rec. Ind. Mus. I, pp. 179–196, 8 text-figs.

—— 1912. The Marine Polyzoa of the Indian Ocean from H.M.S. "Sealark." Trans. Linn. Soc. London, XV, pp. 137–157, 1 pl.

—— 1916. Report on the Polyzoa, in Hornell, Rep. Mar. Zool. Okhamandal in Kattiawar, II, pp. 157–165, 6 text-figs.

Waters, A. W. 1879. On the Bryozoa of the Bay of Naples. Ann. Mag. Nat. Hist. 5, III, pp. 28–43, 4 pls.

—— 1885. Cheilostomatous Bryozoa from Aldinga and the River Murray Cliffs, South Australia. Quart. J. Geol. Soc. London, XLI, pp. 279–310, 1 pl.

—— 1887. Bryozoa from New South Wales, North Australia, etc. I–III. Ann. Mag. Nat. Hist. 5, XX, pp. 81–95, 181–203, 253–265, 4 pls.

—— 1888. Supplementary Report on the Polyzoa. Rep. Zool. Chall. Exp. LXXIX.

—— 1889. Bryozoa from New South Wales, IV. Ann. Mag. Nat. Hist. 6, IV, pp. 1–24, 3 pls.

—— 1904. Bryozoa. Res. Voy. Belgica, pp. 1–113, 9 pls., 3 text-figs.

—— 1909. Rep. Mar. Biol. Sudanese Red Sea. The Bryozoa. I, Cheilostomata. J. Linn. Soc. London, XXXI, pp. 123–181, 8 pls.

—— 1910. *Op. cit.*, II. Cyclostomata, Ctenostomata, Endoprocta. J. Linn. Soc. London, XXXI, pp. 231–256, 2 pls.

—— 1913. The Marine Fauna of British E. Africa and Zanzibar. . . . Bryozoa. Cheilostomata. Proc. Zool. Soc. London, pp. 458–537, 10 pls.

—— 1918*a*. Bryozoa of the Cape Verde Islands. J. Linn. Soc. London, XXXIV, pp. 1–45, 4 pls.

—— 1918*b*. Some Mediterranean Bryozoa. Ann. Mag. Nat. Hist. 9, II, pp. 96–102, 1 pl.

—— 1925. Ancestrulae of Cheilostomatous Bryozoa, III. Ann. Mag. Nat. Hist. 9, XVI, pp. 529–545, 2 pls.

Whitelegge, T. 1889. List of the Marine and Fresh-water Invertebrate Fauna of Port Jackson and the Neighbourhood. J. Roy. Soc. N.S.W., pp. 163–323.

INDEX

(The principal references are in heavy type.)

DESCRIPTION OF PLATE I.

A, *Petralia litoralis*, Livingstone MS., sp. n. Type-specimen. × c. 10. Photograph by Mr. Livingstone. *a.*, Avicularium.

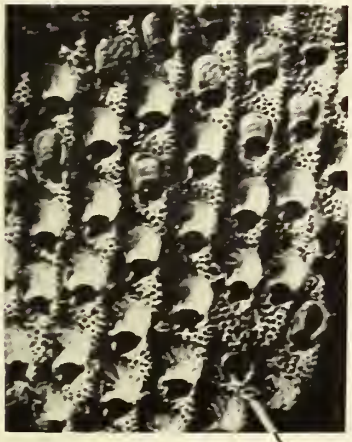
B, *Vittaticella buskii* (Wyv.-Thom.), from the Hong-Kong Manila Cable. Natural size.

C, *Schizomavella australis* (Haswell). Natural size.

D, *Microporella mutabilis*, sp. n. Type-specimen. Natural size.

E, *Retepora monilifera* var. *benemunita* (Busk MS.), var. n. Type-specimen. Natural size.

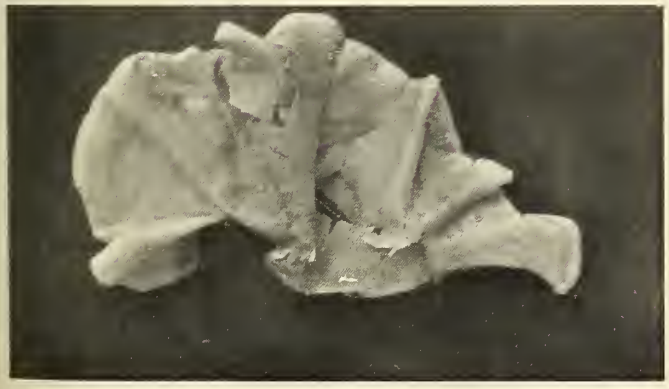
A



a

B

C



D

E

[*Adlard & Son, Ltd., Impr.*